Ecological justice in agricultural systems

An evaluation of success factors and barriers by the example of the Philippine farmer network MASIPAG

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Abstract: Two big challenges arise from the normative aim of ecological justice to the management of agricultural systems: (1) the improvement of food security and livelihood of the rural poor today regarding intragenerational justice; (2) the sustenance and enhancement of long-term productivity and resilience of agricultural systems to future generations regarding intergenerational justice. The paper aims to reveal the success factors and barriers of the Philippine farmer network MASIPAG in realizing both aims of ecological justice. The case study analysis is philosophically based on Rawls' "A Theory of Justice" (1971), conceptually on certain determinants of the relationship between intragenerational and intergenerational ecological justice (Glotzbach and Baumgärtner 2011) and empirically on the results of a comprehensive evaluation of the MASIPAG network (Bachmann *et al.* 2009).

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1. From world agriculture to the Philippine farmer network MASIPAG

Although world agriculture produces enough food to sufficiently feed everyone in the world, it has two huge drawbacks: failure in combating hunger and environmental degradation. According to the United Nations Food and Agriculture Organization, 925 million people were undernourished in October 2010 (FAO 2010: 8), most of them living in rural areas and highly dependent on agriculture, grazing, and hunting for subsistence (MEA 2005: 47). Through intensification and expansion of cultivated area, total increases in agricultural yield and livestock have come at growing costs in terms of trade-offs with other ecosystem services, such as biodiversity, pest control, pollination, soil fertility and protection from soil erosion (*ib*.).

Therefore, the management of agricultural systems is confronted with questions of *ecological justice*. The conception of ecological justice underlying this study links the ideas of intragenerational and intergenerational justice to the use and conservation of ecosystems and its services (*cf.* Glotzbach 2011). Two big challenges arise from the normative aim of ecological justice to the management of agricultural systems: (1) the improvement of food security and livelihood of the rural poor today regarding intragenerational justice; and (2) the sustenance and enhancement of long-term productivity and resilience of agricultural systems to future generations regarding intergenerational justice.

Under what conditions can agricultural systems enhance both food security of poor farmers today and the prospects for future farmers? How must institutions be designed to facilitate intragenerational and intergenerational ecological justice in agricultural systems simultaneously? I approach an answer to these guiding questions by analyzing a case study, the MASIPAG farmer network in the Philippines. I choose MASIPAG as the case study object because thoroughly evaluated and comprehensive statistical data about the impact of

MASIPAG on its farmer members and their farmland are available, and because MASIPAG is well-known as a positive example of small-scale agricultural management in developing countries.

The Philippines are an archipelago in Southeast Asia in the Western Pacific Ocean, categorized into the three main geographical divisions Luzon, Visayas, and Mindanao. About one third of the more than 85 million inhabitants in the Philippines are employed in the agricultural sector. Farmers comprised the second poorest sector in 2006 with a poverty incidence of 44% (NSCB 2006), i.e. 44% of all farmer families were not able to meet their basic food and non-food requirements.[1] The staple crop of the Filipinos is rice. Although self-sufficiency in the production of rice is an explicit national policy, even stated in the Philippe constitution, rice imports have increased up to 8% of total rice supply in 2002 (Tolentino 2006: 3).

MASIPAG is a network of small-scale farmers cultivating organic rice-based agricultural systems in the Philippines, associated with farmers' organizations, scientists and non-governmental organizations (Bachmann *et al.* 2009: 1). The network has been established in 1986 on a rice conference, which was initiated to discuss the negative impacts of the Green Revolution on Philippine farmers (*ib.* 6*f.*). The Green revolution caused most Philippine small-scale farmers to convert their cultivation from traditional rice varieties to the chemically-dependent, genetically uniform "high-yielding varieties" of the International Rice Research Institute (IRRI). Subsequently, many farmers became indebted and lost the self-determination in their agricultural mangement.

MASIPAG aims to improve the situation of resource poor small-scale farmers and to empower them (*ib.* 2). In 2009 the organization counted approx. 35.000 farmer members, tilling an average farm size of about 1,5 ha (*ib.* 13). To become a member of MASIPAG,

[1] A Filipino family of five needed 6274 Philippine peso monthly income in 2006 to stay out of poverty.

farmers only have to signify their intention. The core of the MASIPAG approach is the open and free access to seeds, which are respected as common good. MASIPAG farmers breed their own varieties of rice from the old traditional rice varieties, collect and share them, enhance their on-farm diversity and farm without artificial fertilizers and pesticides. MASIPAG has cultivated more than 2000 rice varieties, which are adapted to the specific local environmental conditions (*ib.* 6).

An evaluation of the MASIPAG network on *"Food Security and Farmer Empowerment: A study of the impacts of farmer-led sustainable agriculture in the Philippines"* (*ib.*) has been conducted and published in 2009. It compares findings from 280 full organic MASIPAG farmers and 280 conventional farmers regarding food security, health outcomes and livelihood, corn yields and productivity, various environmental outcomes, farmer knowledge and empowerment. Both food security, health outcomes and livelihood, especially of the poorest farmers, have been enhanced, and the state of the agro-ecosystems (including on-farm diversity, soil fertility and tolerance of crops to pests and diseases) has been improved. These findings point to an improvement of intragenerational as well as intergenerational ecological justice. The paper aims to reveal the success factors and barriers of the MASIPAG network in realizing both intragenerational and intergenerational ecological justice.

The general relationship between intragenerational and intergenerational ecological justice has already been investigated in a systematic manner (Glotzbach and Baumgärtner 2011). The analysis of political documents and the scientific literature showed that the relationship crucially depends on six determinants: (1) quantity and quality of ecosystem services, (2) population development, (3) substitutability of ecosystem services by human-

made goods and services, (4) technological progress, (5) institutions and (6) political restrictions (*ib.*). In this paper, I apply the explanation attempt to the MASIPAG example.

The paper is organized as follows. In Section 2, I discuss the measurement of ecological justice within the Philippines agricultural systems, and build an indicator set of intragenerational ecological justice and one of intergenerational ecological justice. In section 3, I examine the extent of intragenerational and intergenerational ecological justice realized in MASIPAG farming systems with reference to conventional farming systems in the Philippines. In section 4, I investigate how each of the six determinants of the general relationship between intragenerational and intergenerational ecological justice impacts on the indicator sets of ecological justice. In the final section, I summarize the findings of the investigation and discuss what the specific MASIPAG results imply for an ecologically just management of agricultural systems in general.

2. Measuring ecological justice within the MASIPAG agricultural systems

To develop philosophically founded indicators of ecological justice, it is instructive to build on established theories of justice. In a previous paper I showed that the “A Theory of Justice” by John Rawls (1971) is an appropriate theory for deriving a conception of ecological justice (Glotzbach 2011). Rawls' original position can be consistently extended to include representatives from the present and actual future generations, who decide on the distribution of rights to ecosystem services. They would regard essential, non-substitutable ecosystem services as necessary primary goods to realize their basic right to physical integrity and all other ecosystem services as further social primary goods. The representatives would agree on

two *principles of ecological justice*: (1) Each present and future person has the same indefeasible claim to a fully adequate set of essential and non-substitutable ecosystem services, which is compatible with the same set for all; (2) Inequalities in the distribution of the sum of all non essential and substitutable ecosystem services as well as its substitutes are to be to the greatest benefit of the least-advantaged members of the present and actual future generations (*ib.*). These general principles integrate the intragenerational and the intergenerational dimension of ecological justice. To allow the measurement of intergenerational and intragenerational ecological justice in MASIPAG farming systems, it is necessary to derive separate and context-specific indicators of intergenerational and of intragenerational justice.

The first principle of ecological justice has priority to the second principle of ecological justice. That implies that one agricultural system is ecological just to a higher degree than a second agricultural system if it provides a more adequate set of essential and non-substitutable ecosystem services to all members of the community of justice than the second system – regardless whether the second agricultural system performs better in terms of the second principle of ecological justice. As some essential ecosystem services are not adequately provided to many conventional and MASIPAG farmers and probably will be to their descendants, it is sufficient to consider the first principle in the process of indicator building.

The first principle is about the access to essential and non-substitutable ecosystem services. Ecosystem services are assumed to be essential if they are necessary resources or conditions for realizing the basic right to physical integrity of present or future persons. They are assumed to be non-substitutable if they cannot be substituted by human-made goods or services with regard to their function for exerting the basic right to physical integrity.

Following the categorization by the Millennium Ecosystem Assessment (MEA 2003: 56*ff.*), the main essential and non-substitutable ecosystem services which are delivered by rice-based agricultural systems to present and future small-scale farmers on the Philippines are listed in table 1.

But what is a *fully adequate set* of essential ecosystem services? How to determine it? Referring to Amartya Sen (Sen 1982: 368) neither the good itself, i.e. the ecosystem service, nor the resulting human wellbeing, but the relation between the delivered ecosystem service and the individual wellbeing drawn out of this ecosystem service is decisive for assessing a distribution as just or unjust. To quantify this relationship, he proposes the measure of basic capabilities, i.e. substantive freedoms that people can achieve with certain primary goods (*ib.*). In terms of the capability approach, essential ecosystem services can be viewed as resources and conditions which enable present and future farmers to exert the basic capabilities encompassed by the basic right to physical integrity.

As shown in table 1 essential ecosystem services substantially impact on, or even determine, three basic capabilities of *present* farmers: being in good health, ensuring food security, making a livelihood. For instance, enhanced regulating ecosystem services improve the stability and resilience of crop yields (food security), higher on-farm diversity and biological control instead of pesticide use promote a more diverse and less polluted diet (health outcomes), practical knowledge in seed selection and plant breeding improve the quality and performance of the farmers' rice selections (food security).

Table 1: Essential ecosystem services delivered by rice-based agricultural systems

categorization of ecosystem services	ecosystem service	basic capabilities
provisioning ecosystem services	food (crops, livestock)	being in good health (meeting nutritional requirements), ensuring food security, making a livelihood
	agrobiodiversity[2] (including the diversity of genetic resources)	being in good health (diverse diet), ensuring long-term and present food security
regulating ecosystem services	maintenance of soil fertility	ensuring long-term and present food security
	erosion control	ensuring long-term and present food security
	biological control	ensuring long-term and present food security
	moderation of extreme events (storm, drought, flood, climate change)	ensuring long-term and present food security
cultural ecosystem services	"learning from nature": knowledge in plant breeding	ensuring long-term and present food security
	social relations (communal support and cooperation)	ensuring long-term and present food security, making a livelihood

Being part of the evaluation of the MASIPAG network, data have been collected on health outcomes, food security[3], livelihood and household annual balance that quantify these three capabilities for MASIPAG-farmers and conventional farmers. Hence, theoretical as well as pragmatic considerations point to an *indicator set for intragenerational ecological justice* that consists of four indicators: food security, health outcomes, livelihood per ha of the poorest quartile of farmers and household annual balance of the poorest quartile of farmers (*cf.* figure

[2] According to the definition by the FAO (1999) agrobiodiversity is "the variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries (…) it also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators)".
[3] The MASIPAG evaluation study refers to the definition of food security by the FAO (Bachmann *et al.* 2009: 20).

1).[4] An increase in one indicator - with the others not getting worse - means an increase in intragenerational ecological justice.

Intergenerational ecological justice demands sustaining, respectively improving, the potential of ecosystems to produce ecosystem services in the future. To fulfil the first principle of ecological justice with regard to future persons, the ecological funds which are crucial to deliver a sufficient amount of essential and non-substitutable ecosystem services to all future persons need to be sustained. Whether these ecological funds are sustained depends on the state of certain ecosystem services in the present and their future development. These ecosystem services are either ecological funds themselves, e.g. agrobiodiversity, or ecosystem services that increase the stability and resilience of future food production, including soil fertility, tolerance of crops to pests and diseases, moderation of extreme whether events and adaptability to climate change. By contrast, certain human impacts on agricultural ecosystems, including soil erosion, pesticide and fertilizer use, decrease the future quality and quantity of essential ecosystem funds. Based on the data available, I choose an *indicator set for intergenerational ecological justice* that includes six *ecosystem indicators*: (1) on-farm diversity (diversity of rice varieties and crop types), (2) soil fertility, (3) tolerance of crops to pests and diseases, (4) soil erosion, (5) application of chemical fertilizer, (6) pesticide and herbicide use. The ecosystem service moderation of extreme events (storm, drought, flood, climate change) has not been included as a further ecosystem indicator because no data on this ecosystem services have been gathered. As this service is positively influenced by other

[4] For the indicators health outcome and food security no data on the poorest quartile of farmers are available. As essential ecosystem services are not sufficiently provided to at least 44 percent of the farmers (*cf.* NSCB 2006), average values are assumed to be a good approximation on whether essential needs for ecosystem services are met.

ecosystem services, especially by on-farm diversity as risk minimization and adaptation strategy, it is indirectly considered within the indicator set.

The ecosystem indicators are indirect measures of the agricultural ecosystem's future potential to deliver essential ecosystem services. But today only the present state of these ecosystem services and the present extent of harmful human impacts can be identified for MASIPAG farming systems with reference to conventional farming systems. The past development of the ecosystem indicators can only reveal trends for their future development if the MASIPAG network shows intertemporal institutional stability. As Petersen (2009) states, intergenerational justice presupposes sustaining a just institutional structure of a community. Hence, the indicator set for intergenerational ecological justice is completed by the indicator "long-term sustenance of the MASIPAG network".

The ecosystem indicators also need to be supplemented by an indicator on population development as the *relation* of the number of future persons to the future quantity of essential ecosystem services is decisive for meeting the first principle of ecological justice. The *population indicator* which I choose for assessing the MASIPAG systems is the indicator "no increase of average household size of MASIPAG families". [5]

Consequently, an increase in on-farm diversity, soil fertility, tolerance of crops to pests and diseases, or a decrease in soil erosion or fertilizer use or pesticide and herbicide use - with all other ecosystem indicators staying constant – *and* no increase of average household size of MASIPAG families *and* the long-term maintenance of the MASIPAG network together mean an increase in intergenerational ecological justice (*cf.* figure 1).

[5] With farm plots staying equally small and areas under rice cultivation not increasing, total rice-yields and total family livelihood of MASIPAG families probably wouldn't increase significantly. Hence, rice yields and livelihood from agriculture per person would decrease with increasing household size.

Indicator sets

Indicator set for intragenerational ecological justice:

food security

health outcomes

livelihood per ha of the poorest 25%

household annual balance in cash of the poorest 25%

Indicator set for intergenerational ecological justice:

on-farm diversity

soil fertility

tolerance of crops to pests and diseases

soil erosion

application of chemical fertilizer

pesticide and herbicide use

no increase of average household size of MASIPAG families

long-term sustenance of the MASIPAG network (institutional stability)

Figure 1: ***Indicator sets for intragenerational and intergenerational justice***

3. Transformation to greater intragenerational and intergenerational ecological justice

Having build indicator sets for intra- and intergenerational ecological justice, the extent of intra- and intergenerational ecological justice realized in the MASIPAG and the conventional farming systems in the Philippines is determined in this section. By comparing the indicator sets for MASIPAG-farmers with the indicator sets for conventional farmers, the changes in ecological justice between conventional and MASIPAG farming systems are identified.

Table 2 and 3 describe the specific indicators and the corresponding indicator values for MASIPAG farmers and conventional farmers. The last column “comparison” relates the indicator values of MASIPAG and conventional farmers. The sign + indicates that ecological

justice is higher for MASIPAG systems than for conventional farming systems in the dimension of the corresponding indicator.

Table 2: Indicator set for intragenerational ecological justice

indicator	indicator value for MASIPAG farmers	indicator value for conventional farmers	comparison
food security (perceived changes in food security 2000-2007, Bachmann *et al.* 2009: 22)	88% (better or much better) 2% (worse)	39% (better or much better) 18% (worse)	+
health outcomes (perceived change in health status 2000-2007, *ib.* 29)	83% (better or much better) 4% (worse)	29% (better or much better) 16% (worse)	+
livelihood per ha of the poorest 25% (net agricultural income + value of farm products consumed by the household, *ib.* 25)	12.610 pesos (mean: 51.448 pesos)	8.590 pesos (mean: 32.062 pesos)	+ (difference is statistically significant)[6]
household annual balance in cash of the poorest 25% (gross income - total expenditure, *ib.* 49)	-3.366 pesos (mean: 4,749 pesos)	-10.893 pesos (mean: -4,992 pesos)	+ (but still in the red)

Table 3: Indicator set for intergenerational ecological justice:

indicator	MASIPAG farmers	conventional farmers	comparison
on-farm diversity : number of rice varieties (Bachmann *et al.* 88) number of crop types grown per farm (*ib.* 25)	4,8 45	1,6 30	+ + (differences are both highly statistically significant)
soil fertility (observed changes in soil fertility 2000-2007, *ib.* 94)	84% (better) 2% (worse)	3% (better) 53% (worse)	+

[6] The statistical significance level chosen in the evaluation study is 0,05 (Bachmann *et al.* 2009: 11).

tolerance of crops to pests and diseases (observed changes in tolerance of crops to pests and diseases 2000-2007, *ib.* 93)	81% (better) 3% (worse)	13% (better) 41% (worse)	+
soil erosion (observed changes in soil erosion 2000-2007, *ib.* 93)	59% (reduction) 6% (increase)	6% (reduction) 32% (increase)	+
application of chemical fertiliser (*ib.* 89)	0%	75% (220 kg per ha)	+
pesticide and herbicide use (*ib.* 91)	0%	80%	+
no increase of average household size (changes in household size of household members 2000-2007, *ib.* appendix 2)	-0,4	-0,3	no increase for both MASIPAG and conventional farmers

The indicator sets show that both intragenerational and intergenerational ecological justice are higher for MASIPAG farmers as compared with conventional farmers. Because all indicators – except the population indicator which shows no significant differences between MASIPAG and conventional farmers - point into the same direction towards greater ecological justice in MASIPAG farming systems, a weighting or aggregation of the single indicators is not necessary.[7] However, it has to be noticed, that household annual balance is still in the red for the poorest quartile of MASIPAG farmers.

The indicator "long-term sustenance of the MASIPAG network" cannot be measured directly with the available information. Still, some elements favoring the long-term sustenance of the MASIPAG network can be figured out, such as high internal satisfaction with the work of MASIPAG among its farmer members, high involvement of the MASIPAG

[7] For this specific case study the problem of redundancy, ascribed by Sen (2009: 16) to theories of justice following the "transcendental institutionalism", does not appear. The different dimensions of evaluation, i.e. the single indicators, all show the same ranking in terms of intragenerational resp. intergenerational ecological justice and therefore a comparative approach produces an unambiguous solution.

farmers in the organization, and reputation beyond its own members at the communal level. These elements are discussed in the context of the determinant institutions (section 4.5).

4. Determinants of intragenerational and intergenerational ecological justice in the MASIPAG case study

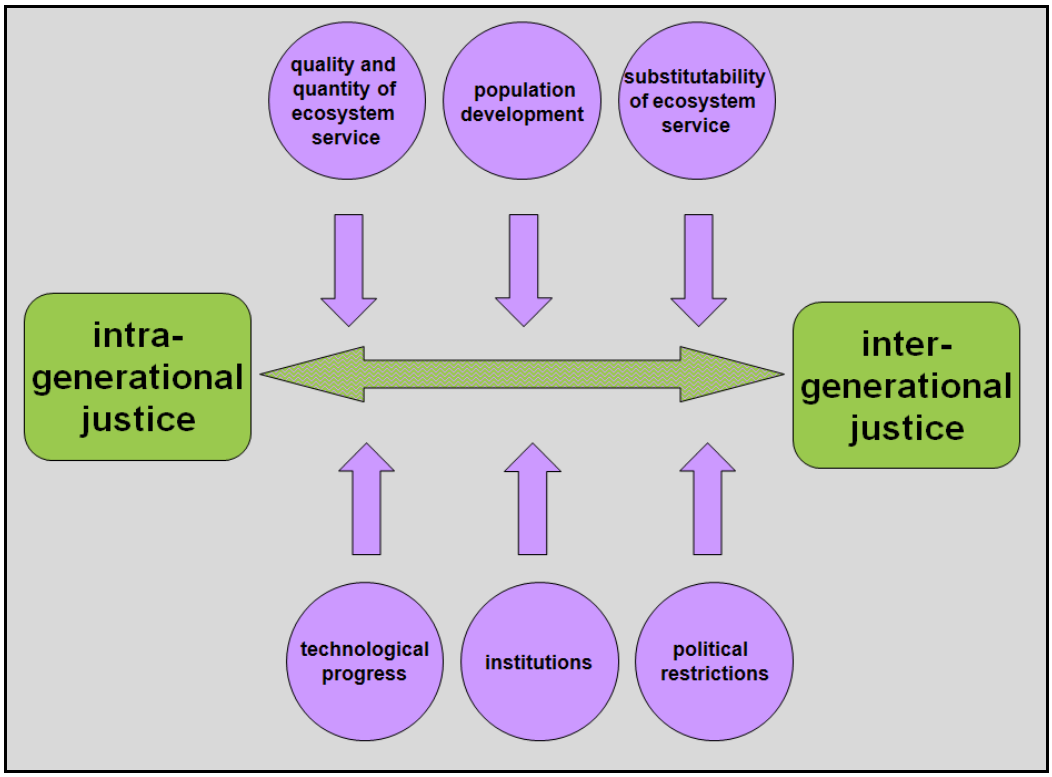

Figure 2: ***Determinants affecting the relationship between the objectives of intragenerational and intergenerational ecological justice (from Glotzbach & Baumgärtner 2011)***

An investigation of the general relationship between intragenerational and intergenerational ecological justice (Glotzbach and Baumgärtner 2011), based on a qualitative content analysis of political documents and the scientific literature, revealed that the relationship crucially depends on six determinants: (1) quantity and quality of ecosystem services, (2) population development, (3) substitutability of ecosystem services by human-made goods and services,

(4) technological progress, (5) institutions and (6) political restrictions (Glotzbach & Baumgärtner 2011, *cf.* figure 2).

To prove this explanation attempt and to reveal the specific success factors and barriers of the MASIPAG network with respect to ecological justice, I discuss for each determinant how it impacts on the indicator values for intragenerational and intergenerational ecological justice in the MASIPAG farming systems.

4.1 Quantity and quality of ecosystem services

The MASIPAG farmers have significantly increased essential ecosystem services, including on-farm diversity, maintenance of soil fertility, biological control and erosion control (*cf.* table 4). Probably a positive interaction between these ecosystem services has been occurred, with on-farm diversity being a core link (*cf.* Elmquist *et. al.* 2010). Also the quantity of essential cultural ecosystem services has been increased (*cf.* table 4).

The evaluation results indicate that equally high rice yields (*cf.* table 4), being the most important ecosystem service to present farmers, are compatible with higher on-farm diversity and environmentally sound agricultural management in the short run *and* in the long run. Hence, the MASIPAG management approach produces neither trade-offs between the enhancement of different essential ecosystem services (e.g. rice production versus on-farm diversity), nor trade-offs between the enhancement of essential ecosystem services at different points in time (e.g., rice production today versus rice production in the future). The high crop productivity of the MASIPAG agricultural systems is probably partly due to the local farmers' skills in rice breeding and selection, and partly due to the variable environment that makes risk reducing strategies based on on-farm diversity profitable already in the short run.

On-farm diversity, maintenance of soil fertility, biological control and erosion control are itself indicators of intergenerational ecological justice. Therefore, their increase favors a total increase of the indicator set of intergenerational justice. These ecosystem services also positively impact the indicators of intragenerational ecological justice, as these indicators depend on the whole range of essential ecosystem services (*cf.* table 1).

Table 4: Quantity of essential ecosystem services in MASIPAG and conventional farming systems

ecosystem service	MASIPAG farming systems	conventional farming systems
rice yield (rice paddy yields in kg/ha, Bachmann *et al.* 2009: 56)	3.424 (2007)[8] 3.374 (2000)	3.478 (2007) 3.570 (2000)
livestock (carabao ownership, *ib.* 60)	60%	49%
on-farm diversity : number of rice varieties number of crop types grown per farm	 4,8 45	 1,6 30
maintenance of soil fertility (observed changes in soil fertility 2000-2007)	84% (better) 2% (worse)	3% (better) 53% (worse)
biological control (observed changes in tolerance of crops to pests and diseases 2000-2007)	81% (better) 3% (worse)	13% (better) 41% (worse)
erosion control (observed changes in soil erosion 2000-2007)	59% (reduction) 6% (increase)	6% (reduction) 32% (increase)
knowledge in plant breeding (verification trials of rice seed, *ib.* 57)	70%	3%
social relations: involvement in communal labor (*ib.* 80) development of marketing groups (*ib.* 81)	 32% 6-16%	 18% 1%

[8] The differences in rice yield between MASIPAG and conventional farmers are not statistically significant (Bachmann *et al.* 2009: 55). Also the trends, a slight decline for conventional farmers and a slight increase for MASIPAG farmers from 2000-2007, are not statistically significant (*ib.* 56).

The *quality* of ecosystem services refers to two fundamental characteristics: *rivalry/non-rivalry in consumption* and *excludability/non-excludability from use*. All ecosystem services that have increased under MASIPAG farming practices are characterized by non-rivalry in consumption, i.e. their use by one person does not diminish another person's ability to use the same service. For example, all MASIPAG farmers can profit from the breeding of new, better adapted crop varieties as it extends the communal seed bank.

4.2 Population Development

The determinant *population growth* refers both to the *growth rate of human population* in total and to the spatial *distribution of demographic development* at present and projected into the future. Population development decides on the relation of the number of future persons to the future delivered quantity of essential ecosystem services. Therefore, intertemporal stability or decrease of average household size of MASIPAG families is chosen as an indicator for intergenerational ecological justice within the investigated agricultural systems.

There have been 88,57 million inhabitants living in the Philippines in 2007, more than half of them (56.2 percent) in Luzon, 24.4 percent in Mindanao and 19.4 percent in Visayas (Commission on Population 2007). The average annual population growth rate for the Philippines was 2,04 percent for the period 2000 to 2007, being the lowest rate recorded for the Philippines since the 1960s (*ib.*). The average household size has decreased from 5,0 persons in 2000 to 4,8 persons in 2007 (*ib.*).

The available data on MASIPAG and conventional farmers' households show that there is no significant difference in their average household size (Bachmann *et al.*: appendix 2). For the period 2000 to 2007 the average household size of both MASIPAG farmers (from 5,4 household members in 2000 to 5,0 household members in 2007) and conventional farmers

(from 5,4 household members in 2000 to 5,1 household members in 2007) has decreased (*ib.*). Hence, the average household size of the farmers under study shows a greater rate of decrease than the national average.

No reliable data are available on projections about the future development of total agricultural population in the Philippines in general and about the future demographic development of MASIPAG farmers' household size in specific. Therefore, no scientifically based statement can be given on whether the indicator "no increase of average household size" will be met during the next decades. Against the background of projected increase in total population in the Philippines, an increase in household size of MASIPAG farmers should be recognized as a *potential* danger to intergenerational justice.

4.3 Substitutability of ecosystem services by human-made goods and services

The substitutability of ecosystem services refers to the availability of human-made functional substitutes for every single individual. An ecosystem service is substitutable by a human-made good or service if the human-made good or service can equally promote the exertion of certain basic capabilities.

MASIPAG reverses the management practice to substitute for ecosystem services by artificial inputs. The network focuses on the enhancement of regulating ecosystem services such as biological control and moderation of extreme events. The evaluation results indicate that human-made goods cannot fully substitute for several regulating ecosystem services: Chemical fertilizers have not achieved the same effects as ecosystem based measures in terms of soil fertility from 2000-2007 (*cf.* table 4); pesticide and herbicide use have not achieved the same effects as biological control in terms of tolerance of crops to pests and diseases (*ib.*). But

maintenance of soil fertility and tolerance to pests and diseases are crucial preconditions for long-term food security. Substitutes for the ecosystem service moderation of extreme events (such as typhoons, flooding and droughts, increased in frequency and intensity by climate change) are partly technically possible, but locally not available or not affordable in contrast to on-farm diversity. On-farm diversity cannot be fully substituted because of its multifunctionality for agricultural systems, such as its function for pest control, pollination, maintenance of soil fertility, protection of water courses against soil erosion, and for resilience and adaptiveness of agricultural systems in the face of climate change.

The provisioning ecosystem service crops (especially rice) impacts on several capabilities: being in good health, ensuring food security, making a livelihood. In its function for health and food security crops are non-substitutable for small-scale farmers in the Philippines, but in its function for livelihoods they are partly substitutable. Lower input costs[9] and higher market value can partly substitute for lower rice yields. In case of the MASIPAG network, the dropped expenditures for external inputs and the enhancement of market value (*ib.* 39) have increased livelihood under constant crop yields. This is one determinant for the increase in the indicators for intragenerational justice livelihood and household annual balance.

4.4 Technological Progress

In the context of ecological justice, technological progress is defined as the rate of increase in ecological efficiency realized by innovation of new technologies, or by means of technology and knowledge transfer of already existing technologies. For farming systems in the

[9] Agricultural inputs, i.e. chemical fertilizers, pesticides, herbicides and seeds, are the single most important production cost of conventional farmers, and would increase the expenses of MASIPAG farmers by an average of 9.334 pesos (Bachmann *et al.*: 41). Thus, the MASIPAG management approach reduces farm expenditures by promoting the free and more effective regulating ecosystem services.

Philippines an increase in ecological efficiency means less environmental impacts, including soil erosion, pesticide use, fertilizer use, fossil fuel use and greenhouse gas emissions, and/or enhanced ecosystem services, such as on-farm diversity and soil fertility, per unit rice yield.

A significant increase in ecological efficiency in MASIPAG farming systems has been realized through adoption of sustainable agricultural management (*ib.* 85*ff.*), encompassing the elimination of chemical fertilizers and pesticides, better soil management techniques, alternative pest management, participatory and on-farm breeding activities as well as higher on-farm diversity (i.e., more rice varieties and crop types).

The increase in ecological efficiency in MASIPAG systems goes along with a direct positive impact on the indicators of intergenerational ecological justice, and hence increases intergenerational ecological justice. The ecological efficiency increase also has an indirect positive impact on the indicators of intragenerational ecological justice (*cf.* table 1).

4.5 Institutions

The determinant *institutions* includes all mechanisms which structure and govern human use of ecosystem services at all levels of society. A great institutional threat to ecological justice within the MASIPAG farming systems constitutes the patenting of life forms and life processes as it is a tool to effectively take the control over their seeds from the MASIPAG farmers (*cf.* Medina 2002). In this paper, the focus stays with the institution MASIPAG although there are further institutions impacting on the relationship between intragenerational and intergenerational ecological justice (*cf.* following subsection on political restrictions).

The MASIPAG network has enhanced intragenerational and intergenerational ecological justice by establishing technological and social change. Technological change, basically the adoption of environmentally sound and long-term oriented agricultural

management, has been discussed in the previous subsection. Social change has promoted ecological justice in three ways: first, it enhanced the cultural ecosystem services; second, it facilitated broad adoption of technological change; third, it improved the intergenerational institutional stability of the MASIPAG network. In the following, these points are outlined in detail.

The type of ecosystem management established by the MASIPAG network favored cultural ecosystem services, especially learning from nature (knowledge systems) and social relations (*cf.* table 4). The service "learning from nature" can be measured by the indicator "verification trials of rice seed" (*cf.* Bachmann *et al.* 2009: 56*f.*). In verification trials farmers test different varieties of rice seeds for their performance under local conditions: first on a local "trial farm", then on their own farms (*ib.* 74). They learn to observe how the rice plant grows and reproduces, what influences growth of different varieties, and which variety performs best under specific local conditions. This type of seed selection is sensitive to environmental changes, e.g. triggered by climate change, equips MASIPAG farmers with good skills and practical knowledge in seed selection and plant breeding, and thereby improves quality and performance of their rice selections. The evaluation results on rice yields, which are equally high for MASIPAG farmers as for conventional farmers using the "high-yielding varieties" of the IRRI (*ib.* 56), support the success of the MASIPAG farmers' skills in seed breeding and seed selection.

Community based ecosystem management, including participatory seed breeding on trial farms, communal seed collection and free seed exchange in the MASIPAG network, went along with the improvement of the cultural ecosystem service "social relations". Better social relations manifested in higher involvement in communal labour and more frequent development of marketing groups of MASIPAG farmers in comparison to conventional

farmers (*ib.* 80*ff.*). Involvement in communal labour has helped poor farmers to increase their income and food security, e.g. by the sharing of carabao (*ib.* 80*f.*). Marketing groups had a significant positive effect on income (*ib.* 82), and hence on the intragenerational justice indicator livelihood.

The social organization of the MASIPAG network is crucial to the broad adoption of technological improvements. In February 2011 more than 35.000 farmers were members of MASIPAG, whereas the staff was only 42 persons in four MASIPAG offices. To reach a wide range of people, the farmer-led approach of MASIPAG is indispensable. Around 200 farmer-trainers provided trainings, coaching and monitoring support to other farmers in February 2011. The success of the farmer to farmer dissemination of technology becomes appeared in two evaluation results: Both training rates of organic farmers and adoption rates of trained farmers are high (*ib.* 75). 83% of MASIPAG farmers have received training in cultural rice management; more than 75% have received training in soil fertility management and alternative pest management. The adoption rates are between 65-78%, depending on the training topic (*ib.*).

Long-term sustenance of the MASIPAG network is a *necessary* precondition for intergenerational ecological justice as it allows the ecosystem indicators to become effective in the future. The MASIPAG network is characterized by some elements that favor its long term sustenance and hence intergenerational justice.

First, the network has been established as and still is a bottom-up approach. It gives the priority to farmers in the decision making structures at all levels, including planning, research, implementation and evaluation (*ib.* 67*ff.*). Farmer leaders, farmer breeders and farmer knowledge loom large in the network. This probably makes MASIPAG more independent

from permanent external funding and technical support while at the same time facilitating the empowerment of the farmers. Second, there is high internal satisfaction with the work of MASIPAG among its farmer members (*ib.* 76) and high involvement of the MASIPAG farmers in the organization, with half of them being leaders in people's organizations and a third being farmers' trainers or committee members (*ib.* 72) . Third, reputation beyond its own members is relatively high as compared with reputation of government agencies and other NGOs, and MASIPAG technologies are used by non-member farms at the community level (*ib.* 79). These three elements are favorable to the intergenerational justice indicator "long-term sustenance of the MASIPAG network".

4.6 Political restrictions

Political restrictions are limits to an alteration of institutions. The MASIPAG network could obviously establish within the national political institutions, and it could change institutional structures in the Philippine farming systems. Although the MASIPAG network proved to enhance both intragenerational and intergenerational ecological justice, there are political restrictions on higher institutional levels that have restricted and will restrict further improvement of ecological justice. The main political restriction on the national level is the deficiency in agrarian reform; one important political restriction on international level is the failure in climate change mitigation. Discussing such higher-level restrictions is important because most MASIPAG farmers are still close to the poverty threshold, average farm size both for conventional and MASIPAG farmers is only about 1,5 ha[10] (*ib.* 13), and household annual balance is still in the red for the poorest quartile of MASIPAG farmers (*ib.* 49).

[10] The national average in farm size was 2,0 ha in 2002 (NSCB 2005).

Agrarian reform

Historically, as legacy of the Spanish and American colonial periods, the Philippines were characterized by sharp inequalities in the distribution of land ownership (Fuwa 2000: 26*ff.*). As a consequence, cycles of peasant unrest and rural insurgencies and subsequent partial land reform occurred (*ib.* 1). Land reform has been on national political agenda at least since the early 20th century, and national reform legislation has gradually expanded the scopes for land redistribution over time (*ib.*). Nevertheless, land reform has faced and still faces implementation deficiencies (Balisacan & SEARCA 2007, Fuwa 2000). The latest legislation, the Comprehensive Agrarian Reform Program (CARP) from 1988, is the most comprehensive land redistribution program in Philippine history, and includes the transfer of public land and private agricultural lands from the big landlords to landless farmers. With CARP(ER)[11] landless farmers have gained the right to acquire up to 3 ha of a landlord's land, on condition that they have tilled this land before as tenant farmers or farm workers. CARP is criticized to suffer "from legal loopholes[12], budgetary shortage, and lack of adequate administrative capacities, which hinder swift and massive land redistribution" (Fuwa 2000: 75). As there is only a poor land information system existing in the Philippines, controlling evasion and monitoring land ownership faces serious problems (Ballesteros & dela Cruz 2006: 17). Although some MASIPAG farmers in the survey were able to access more land with the extended agrarian reform programs of the government from 2000-2007 (Bachmann *et al.* 2009: appendix 2), 38% of the MASIPAG farmers and 45% of the conventional farmers under study did not own any of their tilled farmland in 2007 (*ib.*).

[11] CARP has been renamed into *CARPER* (CARP-Extension with Reforms).

[12] Land used for industrial purposes, for fish farming and as pastureland does not fall within the scope of CARP. As a consequence, several landlords signed over their land to a company, or declared it as pasture land or land for fish farming.

Beyond land reform, agrarian legislation in the Philippines is characterized by distortionary government interventions, such as taxes, output and input subsidies and subsidized credit schemes that favor larger farms (Fuwa 2000: 64). Such distortions are for example high import protection for sugar producers that favor the hacienda-organized sugar farms (*ib.*). In contrast, small-scale farmers have very limited access to credit facilities except at the highly inflated interest rates of informal money lenders, making them economically vulnerable (Bachmann *et al.* 2009: 48). Furthermore, foreign investors compete with small-scale farmers for farmland. The Philippine government has permitted foreign investors to lease 1,37 million ha of agricultural land during the presidency of Gloria Macapagal-Arroyo (2001-2010) (Kwok 2010).

Legal loopholes, prolonging and evasion of reform implementation and distortionary government interventions reflect the strong political force of the landlords on national political dynamics (Fuwa 2000: 49). In addition, farmers who claim their right to land through CARP(ER) reform are often exposed to physical and legal harassments by their landlords and other opposers of the CARP reform (Narjes & Dürselen 2008). These local and national political restrictions limit the scope for increasing intragenerational justice as they hinder CARP-implementation and thereby the transfer of land ownership to landless small-scale farmers.

However, after the fall of the Marcos dictatorship in 1986, local peasant organizations have emerged and linkages among these local organizations, national non-governmental organizations and pro-reform state actors have been strengthened (Fuwa 2000: 49). There are some cases where these new movements could counter-balance the political force of the landlords and successfully enforce implementation of legal land rights (*ib.*). MASIPAG also states the issue of genuine land reform (land conversion, CARP assessment, food security) as one of its advocacy issues (MASIPAG 2004).

International climate politics

Global climate change is a serious threat to small-scale farmers in the Philippines. MASIPAG farmers report increases in droughts, typhoons, flooding and salt water intrusion, both in frequency and intensity (Bachmann *et al.* 2009: 103*ff.*). The IPPC (2007: Chapter 10.2) confirms these observations by MASIPAG farmers. Although MASIPAG farmers use on-farm diversity as risk minimization strategy and although they have established a good social support infrastructure, they will be affected by an increasing number of extreme whether events (*ib.* Chapter 10.3). Thus, intergenerational ecological justice will depend on the enforcement of climate mitigation measures in international and regional climate negotiations which underlie severe political restrictions.

National agrarian reform and international climate politics show that higher-level political restrictions limit the scope of intragenerational and intergenerational ecological justice that the MASIPAG network can achieve.

5. **Conclusion**

In this paper I investigated the success factors and barriers of the Philippine farmer network MASIPAG in realizing intragenerational and intergenerational ecological justice simultaneously. Approaching from the prior principle of ecological justice that all present and future people have equal rights to a fully adequate set of essential and non-substitutable ecosystem services, I derived indicator sets for intragenerational and intergenerational ecological justice. The measurement of ecological justice within MASIPAG and conventional farming systems, based on the results of a former evaluation study, indicated that MASIPAG

systems perform better than conventional systems regarding both indicator sets. Following this, I analyzed how the six general determinants of the relationship between intragenerational and intergenerational ecological justice impact on the two indicator sets. The results can be summarized as follows:

Higher quantity of all regulating and cultural ecosystem services as well as enhanced on-farm diversity, "re-substitution" of human-made goods (such as artificial fertilizers and pesticides) by free and more effective regulating ecosystem services, agricultural management that increases ecological efficiency, an institution that facilitates both technological and social change (knowledge system, social relations, farmer-led approach), and the possibility of MASIPAG to establish within the national political institutions and power structures promote both intragenerational and intergenerational ecological justice.

Still, one determinant clearly opposes the enhancement of ecological justice: political restrictions limit the scope for intragenerational and intergenerational ecological justice. To further increase ecological justice, the MASIPAG approach should especially integrate measures that strive to tackle deficiencies in national agrarian reform. In addition, the patenting of seeds and their genetic components constitutes an institutional threat to ecological justice as the open and free access to seeds is central to the MASIPAG approach.

To conclude on the general explanation attempt, the six determinants have proved to be fruitful and complete categories to reveal the relations between intragenerational and intergenerational ecological justice for the MASIPAG case study.

What do the specific MASIPAG results imply for an ecologically just management of agricultural systems in general? The existence and success of the MASIPAG network is essentially based on the high involvement of the MASIPAG farmers in the organization.

Therefore, the MASIPAG approach as a whole cannot be established in other regions using a top down approach. But the network's core success factors and barriers, as identified with the determinant analysis, can be valuable guidelines for other already existing or evolving farmer networks striving towards ecological justice.

6. Literature

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