Applied Studies in Agribusiness and Commerce – APSTRACT
University of Debrecen, Faculty of Economics and Business, Debrecen
SCIENTIFIC PAPERS
DOI: 10.19041/APSTRACT/2024/1/2

A POTENTIAL USE OF A LANDSCAPE INTEGRATED MANAGEMENT TOOL TO MEASURE THE PROGRESS TOWARDS SUSTAINABILITY: A TRIAL APPLICATION AT THE GRAPE-PRODUCING COMPANY HÉTSZŐLŐ –TOKAJ REGION – DEBRECEN - HUNGARY

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Abstract: *Sustainable integrated management at the landscape scale is increasingly becoming paramount for the private and public sectors, as these sectors recognize the high relevance of promoting integrated and collaborative governance in their operating areas and territories. There has been no attempt to apply this approach in the current sustainability reporting frameworks. This paper aims to run a trustful assessment at the Hétszőlő viticulture company to make sustainability claims. This paper applies a new way of reporting sustainability by selecting and assessing suitable indicators within the Ecosystem, Human well-being, and Production pillars depending on the landscape context and conditions, followed by a performance metric selection, prioritization process, and sustainability claiming. Our results portray that out of 21 indicators, including core and landscape-dependent indicators, nine were determined as applicable; likewise, concerning metrics selection, five performance metrics were defined as required, two were recommended, and one was optional. The company's top prioritized indicators are ecosystem restoration (1.06 % of restored areas nationwide), household income (0.3 % nationwide = < $2.5/day), and health and nutrition (<2.5 % = 42500 children). It is ultimately given some claims that actions must be taken in these prioritized metrics and make positive progress toward sustainability.*

Keywords: *integrated landscape management; sustainability claim; performance metrics, core indicator, landscape–dependent indicator*
(JEL code: Q01, Q57)

INTRODUCTION

Over the last decades, much has been done for initiatives related to landscape-integrated management approaches, leading to a controversial debate in international world parties. In that context, a collision between demand for agricultural land and environmental protection goals has arisen. As the saying goes, we face a "perfect storm" as we struggle to feed a burgeoning population on a diminishing land supply, water, nutrients, and biodiversity. (JEFFREY SAYER et al.,2012). Likewise, much has been done for companies and governments to tackle a broad range of alarming issues that currently affect our Landscape, from implementing sectorial programs and initiatives to complex tools that have already been released and others in the construction process. However, on the one hand, these entities lack a recognized method of calculating and communicating the environmental, social, economic, and governance benefits of their actions; consequently, a handprint

approach could be extended to a more holistic sustainability approach through which trade-offs between different impact categories and compromises between the beneficial impacts on various dimensions of sustainability could be identified and avoided in the sustainable value creation process for individuals, organizations, and governments (GRONMAN et al., 2018). On the other hand, an Integrated Landscape Initiative can provide a constructive platform to convene stakeholders in a way that brings a broad set of perspectives and interests to address landscape management challenges in effect; this means the involvement of a large number and diversity of stakeholders in design and implementation, including both internal stakeholders from the Landscape itself and external stakeholders from the public, private, and civil society sectors.(ESTRADA-CARMONA et al., 2014). One concerning trend is that some key stakeholders—particularly those from the private business sector—often appeared to be missing from integrated landscape initiatives (ILIs). This absence is not entirely apparent, but the view is that multi-stakeholder processes may entail a cost and risk for private business (i.e., submitting to a decision-making process with an uncertain outcome) with little financial upside. Regardless of the reason, this participation gap may inhibit the effectiveness of the Integrated Landscape Initiative in addressing weak market linkages. The absence of powerful actors as stakeholders in integrated landscape initiatives also poses a risk that gains achieved through careful multi-stakeholder negotiation could be derailed by significant decisions made outside of such processes. (MILDER et al.,2014). This study aims to try the applicability of a landscape-integrated management tool by assessing its three pillars and indicators in a viticulture company named Hétszőlő to drive improvements towards sustainability and make the right investment decisions and improvements in their operation area. These three fundamental pillars are Ecosystem, Human Well-Being, and Production, including a previous prioritization of the leading applicable indicators in its landscape operation.

MATERIALS AND METHODS

Study area

The trial tool was run within a region called Tokaj situated 250 km east of Budapest, specifically in the grape and wine-producing company Hétszőlő, which owns 49 ha of viticulture estate. the distribution of crops in the estate is grapes as the main crop, apples, and plums. The estate is surrounded by forests in the north, east, and west but in the south, a picturesque settlement of the Tokaj region can be seen.

Data collection

Data collection was done by using a standard sustainability assessment framework template and garnering primary and secondary information sources. Therefore, five to six in-person interviews were needed, and core indicators data were collected by using the Google search engine. Pillars, goals, indicators, and performance metrics primarily form the structure of the trial tool. Eight big goals represent the desired sustainability outcomes within each pillar, and 20 indicators stand for the conditions and processes within the Landscape, which indicate performance related to the goals. These indicators were defined according to their ability to measure sustainability performance and are classified as follows: Core indicators, landscape-dependant indicators, and optional indicators Lastly, Performance metrics define quantitative and qualitative measures of the status or trends of each indicator, for which 31 performance metrics were included in our work.

Table 1. Standard Sustainability Assessment Framework

Pillar	Goal	Indicator	Indicator type	Parameter
1. Ecosystems	1.1. Preserve and recover natural ecosystems.	1.1.1 Natural Ecosystem Protection	Core	1.1.1.1 Total Area (ha) and percentage (%) of each natural ecosystem type under protection
		1.1.2. Natural Ecosystem conversion	Core	1.2.1.1. Total Area (ha) and percentage (%) of area of natural ecosystems in the Landscape that has been recently converted
		1.1.3. Natural ecosystem degradation	Core	
		1.1.4. Ecosystem restoration	Landscape dependent	1.1.4.1. Total Area (ha) under Restoration, disaggregated by ecosystem type and restoration type
	1.2. Protect and rebuild biodiversity.	1.2.1. Threat to species	Core	1.2.1.1. Changes in threats to threatened species 1.2.1.2. Changes in threats to populations of indicator species or other species identified as important in the Landscape

1. Ecosystems	1.2. Protect and rebuild biodiversity.	1.2.2. Biodiversity habitat degradation	Landscape dependent	1.2.3.1 Area (ha) and percentage (%) of area of natural ecosystem that are degraded within areas identified as important for biodiversity.
		1.2.3. Restoration of ecosystems in areas identified as important for biodiversity.	Landscape dependent	1.2.3.1. area (ha) and percentage (%) of land under Restoration within areas identified as important for biodiversity
		1.2.4. Biodiversity habitat protection	optional	1.2.4.1. area (ha) and percentage (%) of areas identified as important for the biodiversity that is designated and managed for long-term protection
	1.3. Maintain and enhance ecosystem services.	1.3.1. Water quantity	Landscape dependent	1.3.1.1. Seasonal water quantity or flow rate of key water bodies (mm/month)
		1.3.2. Water Quality	Landscape dependent	1.3.2.1. Total suspended solids in key water bodies(average(mg/l) 1.3.2.2. Biochemical oxygen demand and chemical oxygen demand (mg/l) or nutrients (nitrogen and phosphorus(load/volume) in key water bodies(required) 1.3.2.3. diversity of aquatic macroinvertebrates in key water bodies (biological monitoring water party or another index when appropriate) 1.3.2.4. concentration of metal or other toxins(load/volume) in key water bodies(required)
		1.3.3. Soil Health	Landscape dependent	1.3.3.1. Average soil erosion rate (t/ha/yr) 1.3.3.2. Soil health (average % Soil Organic Carbon [SOC]) at a representative sample of production sites across the Landscape
2. Human well-being	2.1. Improve the standard of living, especially for vulnerable and/or marginalized groups	2.1.1 Household income and assets	Core	2.1.1.1. percentage of poverty
		2.1.2. health and nutrition	Core	Percentage (%) of children that are undernourished.
		2.1.3. Access to Education	Core	2.1.3.1. Percentage (%) of school-aged children
		2.1.4. Water, Sanitation, and Hygiene	Landscape dependent	2.1.4.1. Percentage (%) pf households without a safely managed sanitation facility exclusive to the household
	2.2. Respect, protect and fulfill human rights	2.2.1. Child labor	Landscape dependent	2.2.1.1. Estimated number of child laborers in economic activities of interest
		2.2.2. Forced labor	Landscape dependent	2.2.2.1. Estimated number of forced laborers in economic activities of interest
		2.2.3. Worker's rights	Landscape dependent	2.2.3.1 Assessor - defined metrics based on identified enabling conditions(required)
3. Production	3.1. Promote transparency, participation, inclusion, and coordination in land-use policy, planning, and management.	3.1.1. Agricultural, agroforestry and tree plantation productivity	Landscape dependent	3.1.1.1. Average crop Productivity(yield/ha) disaggregated by crop
		3.1.2. Input use efficiency in agricultural, agroforestry & tree production systems	Landscape dependent	3.1.2.1. Fertilizer use efficiency (quantity of product produced per unit of nitrogen, phosphorus, and/or potassium (NPK) use.
		3.1.3. Adoption of sustainable land management practices	optional	3.1.3.1. Land area(ha) under major crop, livestock, and/or plantation forestry production that utilizes integrated pest management and percentage (%) of total production area that this represents.

Source: Own Work

RESULTS AND DISCUSSION

Table 2. Standard Sustainability Assessment Framework

Pillar	Goal	Indicator	Parameter	Final result
1. Ecosystems	1.1. Preserve and recover natural ecosystems.	1.1.1 Natural ecosystem protection	1.1.1.1 Total Area (ha) and percentage (%) of each natural ecosystem type under the protection	2022: 2105100 Nationwide
		1.1.2. Natural Ecosystem conversion	1.2.1.1. Total Area (ha) and percentage (%) of the area of natural ecosystems in the Landscape that has been recently converted	2010 -2022: 111726.4 Nationwide
		1.1.4. Ecosystem restoration	1.1.4.1. Total Area (ha) under Restoration, disaggregated by ecosystem type and restoration type	2016 -2022: 92057 Nationwide
	1.2. Protect and rebuild biodiversity.	1.2.3. Restoration of ecosystems in areas identified as important for biodiversity.	1.2.3.1. area (ha) and percentage (%) of land under Restoration within areas identified as important for biodiversity	2022: 2 ha Over the last 20 year
	1.3. Maintain and enhance ecosystem services.	1.3.1. Water quantity	1.3.1.1. Seasonal water quantity or flow rate of key water bodies(mm/month)	Max: 1000 mm/year Min: 277mm/year
2. Human well-being	2.1. Improve the standard of living, especially for vulnerable and/or marginalized groups	2.1.1 Household Income and Assets	2.1.1.1. percentage of poverty	Percentage (%) of poverty at $ 2.15 a day: 0.3 % Nationwide
		2.1.2. health and nutrition	2.1.2.1. percentage (%) of undernourished children.	2019: <2.5 % 42500 children Nationwide
		2.1.3. Access to Education	2.1.3.1. Percentage (%) of school-aged children	2011: 2.7 % 24,053 children not attending school nationwide
	2.2. Respect, protect and fulfill human rights	2.2.1 Child labor	2.2.1.1. Estimated number of child laborers in economic activities of interest	0 Local level
		2.2.2. Forced labor	2.2.2.1. Estimated number of forced laborers in economic activities of interest	0 Local level
3. Production	3.1. Promote transparency, participation, inclusion, and coordination in land-use policy, planning, and management.	3.1.1. Agricultural, agroforestry, and tree plantation productivity	3.1.1.1. Average crop Productivity(yield/ha) disaggregated by crop	2022: 5 Local level
		3.1.2. Input use efficiency in agricultural, agroforestry, and tree production systems	3.1.2.1. Fertilizer use efficiency (quantity of product produced per unit of nitrogen, phosphorus, and/or potassium (NPK) use.	2022: 0.11 Local level
		3.1.3. Adoption of sustainable land management practices	3.1.3.1. Land area(ha) under major crop production that utilizes integrated pest management and percentage (%) of total production area	2022: 49 Local level

Source: Own Work

Ecosystem

In Table 2 above, based on our findings, it can be stated that the indicator can be categorized as optimum since the country has to date protected areas and one nationally protected area at the local level. The fundaments of this result can be attributed to the progressive Hungarian legislation since Hungary hosts 46 habitat types of Annex I (out of which 13 are forest habitats) and 142 species of Annex II (47 of them depend on forests) under the Habitats Directive. Hungary has 18 priority habitat

types (6 of them are forests) and 16 priority species (7 living in forests). Hungary hosts regular populations of 74 bird species (33 depend on forests) listed in Annex I of the Birds Directive, while 48 migratory species (46 occur in forests) are also qualifying features of Special Protection Areas.

This suggests that more action must be considered when dealing with green areas within the grape-producing company's production area. Protect small woods and green areas and boost biodiversity shelter. On one hand, it is important to compare that integrated landscape initiatives coincided positively with the extent of conservation motivation worldwide; in other words, it is reliable to say that nearly 90 % of conservation initiatives took place in Latino America (N. ESTRADA-CARMONA, et al., 2014), 51 % was considered as important in Europe (M. GARCÍA- MARTÍN et al., 2016) and finally 80 % of surveyed initiatives considered as high importance in Africa (C. MILDER – ABIGAIL et al., 2014). This ultimately suggests that either private or public organizations were involved in conservation activities and therefore, the tendency to increase its performance is positive in the long run.

High levels of degradation and deforestation affect the country and the entire subnational level; therefore, the condition is potentially critical. If we compare data from 2000 to 2020, Hungary experienced a net change of 84.6Kha (4.1%) in tree cover. From 2001 to 2021, Hungary lost 228Kha of tree cover, equivalent to an 11% decrease since 2000.

Overall, agricultural use is responsible for around 80 % of deforestation worldwide; concerning developing countries (HOSONUMA, N. et al. 2012). The effects of deforestation have been alarming but natural or artificial forest recovery has been scarce. Action is needed considerably; the country must make more efforts to restore, control, and protect the ecosystems and remaining forests.

Although ecosystem conversion can be related to ecosystem degradation, some credible reports indicate that at least 65 % of institutions (public and private) in 23 countries in Latino America had focused on reducing natural land degradation (N. ESTRADA-CARMONA, et al., 2014). In contrast, 80 % of the initiatives in Africa were running in 33 countries (C. MILDER – ABIGAIL et al., 2014). However, in Europe 21 countries reported the value was quite similar as stated above. Nevertheless, it is important to highlight that the Global Reporting Initiative considers in its agriculture and aquaculture sector this important indicator (Topic) defining it as the conversion of forests through deforestation and the conversion of other ecosystems, such as grasslands, woodlands, or savannas. Deforestation occurs when primary and secondary forests are cleared, often by burning (Consolidated set of the GRI Standards, 2022)

The ecosystem restoration tasks have been made but not at the right intensity of efforts needed. Information was widely spread and not centralized, too much random information could deplete the creditability of the results, and therefore the condition is critical. More transparent and efficient investments are needed to recover the devastated ecosystems. In addition, restoration initiatives involving public and private institutions are quite alike as in the previous indicators mentioned before. This before mentioned information can be corroborated by the fact that the mid-term review of the EU Biodiversity Strategy (EUROPEAN COMMISSION, 2015) states that no significant overall progress was made, the same is true for the Aichi targets (15%) (RSPB, 2016). There is a general opinion of the failure of reaching Aichi targets in the required time frame (LEADLEY et al., 2014; TITTENSOR et al., 2014; CORTINA-SEGARRA et al.,2016; TOLVANEN and ARONSON, 2016; TEH et al., 2017). Despite probable non-compliance, the targets should not be given up (SIMBERLOFF and VITULE, 2014; TOLVANEN and ARONSON, 2016; RUETE et al., 2018). We demonstrated that a remarkable amount of effort is still needed to meet the 15% target. Different approaches to estimating restorable surfaces result in different percentages of restored area; however, they only expand from 1.06% to 5.29%, far from the 15%. In the most permissive version of estimation, when the restorable surface is only based on a semi-natural degraded area estimated by the MÉTA database (describing only 19% of Hungary) instead of the total of L2–4 levels of area (with or without urban and cropland), more than 84,000 ha have to be restored (TÖROK et al. 2019).

The level of reforestation and Restoration with forest or agroforestry species and green cover crops is low; therefore, the condition is critical, and actions are urgently needed. Repopulation tree species are recommended to be planted in the given areas of the company.

It is essential to underline that some sustainability reporting frameworks, such as the Carbon Disclosure Project (CDP) Guidance, include biodiversity as a crucial content element to make credible claims and inform investors, donors, and states about reliable and viable investment possibilities (CDP Climate Change Reporting Guidance, 2023).

The indicator has a positive value of water quantity despite being a rain-fed irrigation system, therefore, the condition is optimum. In effect, this value does not contrast with the climatic condition report given by the Ministry of Agriculture which states that the average annual precipitation is 640 mm, while the average annual temperature is 11.2°C. As aforementioned, the CDP Guidance encourages transparency among companies and cities, enabling organizations to benchmark, measure and manage their environmental risks, and brand reputation and lower their costs through reporting water performance metrics (CDP Climate Change Reporting Guidance, 2023) and it is included as well in the integrated landscapes initiatives in Europe, Latino America, and Africa.

Human well-being

Based on our findings, the poverty indicator was on a base of $ 2.15 income per day and is below the poverty line in Hungary, for which 0.03 percent of the total population is under this condition. This is equivalent to 291300 people struggling with low income nationwide. Moreover, it is essential to mention that some sustainability reporting frameworks, such as the Global Reporting Initiative (GRI) include living income and living wage as an indicators to measure poverty. In contrast, other frameworks do not prioritize it or assess it as an indirect metric (Consolidated set of the GRI Standards, 2022).

According to our findings, the health and nutrition indicator and its categorization as potentially critical as a significant sector of the vulnerable population is under the condition of undernourishment; in other words, 42,500 people lack access to adequate health and nutrition, and more efforts and devoted endeavors are needed to bridge the gap. In addition, making some references to the inclusion of this topic in sustainability reports, the Global Reporting initiative includes this indicator as a priority in its agricultural sector reporting format, defining it as a food security topic (Consolidated set of GRI Standards, 2022). Others only incorporate metrics associated with human rights and food safety (Sustainability Accounting Standard. Food and beverage sector, 2018).

Based on our findings, it can be stated that the indicator related to access to education is categorized as optimum given that a small sector of primary school students is not attending school; in other words, 24,053 school-aged primary students are affected by this problem. It is remarkable to mention that most of the reporting initiatives consider this topic as separate due to its inclination to the private sector and not integrated as a whole to boost progress towards sustainability. One critical sustainability framework is the GRI 404: Training and Education 2016, which only includes three leading employee-based indicators such as average hours of training per year per employee, Programs for upgrading employee skills and transition assistance programs, and Percentage of employees receiving regular performance and career development reviews (Consolidated set of GRI Standards, 2022). This suggests that the Tokaj Hétszőlő company should consider aspects like this; therefore, it could outstand the crowd by supporting educational training at the local level in the Tokaj region.

Based on our findings, it can be stated that the indicator has a positive performance value equivalent to 100 %, which means an excellent contribution to national child labor regulation enforcement. The company is committed to avoiding involving infants and has strict control over them. It is important to highlight that the Global Initiative Standard considers an essential topic in its agricultural sector reporting format and the national sustainable development goals reporting for countries.

Production

Based on our findings, the indicator's value suggests that the company should keep implementing good agricultural practices, particularly organic fertilizer management, to keep at the state-of-the-art level and move forward to touting more inclusive and sustainable market competitiveness. However, it is essential to underscore that 5 Mt/ha is a value close to the national average grape production in Hungary, which is 7 Mt/ha. The variation could be explained by the volcanic rock of the Zemplén Hills and the diversity of the tuffs overlying them, resulting in a production area that is extremely varied in terms of geology. In some places, there are even three distinct types of tuff fragments. On the other hand, Plant protection organic products are pretty well implemented, and organic matter application on crop fields is well managed. A more efficient pest management system is also required. Despite making remarkable efforts in the organic production process, companies' sustainability reporting frameworks do not include this important indicator in their integrated approach. Considering that the Sustainable Development Goals reporting processes are progressing in this topic is only essential.

Based on our findings, it can be seen that the value 0.11 for fertilizer use efficiency indicates an increase in 0.11 kg of the yield of the harvested area per unit of organic fertilizer applied. This means that an even more progressive organic matter application process is needed to keep the quality of the production system and products. However, despite making remarkable efforts in the organic production process, companies' sustainability reporting frameworks do not include this critical indicator as part of their integrated approach. Considering that the Sustainable Development Goals reporting processes are progressing in this topic is only essential.

Based on our findings, it can be seen that the indicator value, despite having the main grape crop, intensification of significant alternative crops needed, such as more apple and plum trees and other cover crops to be incorporated in the viticulture estate. However, it is also essential to mention that the Tokaj Hétszőlő company manage efficiently its solid waste by connecting it to third-party recycling entities of the country.

CONCLUSIONS

Based on our results, this sustainability measuring tool with a landscape-integrated approach turned out to be a ground-breaking and innovative tool for measuring progress towards sustainability, which also can become a potential online measurement system for companies and public sectors and ultimately any organization interested in measuring their credible impact towards sustainability. However, it is important to highlight that global standards such as the International Integrated Reporting Framework (IR), the Carbon Disclosure Project (CDP), the Sustainable Accounting Standard Board (SARB), and the Task Force on Climate-related Financial Disclosures do not integrate a landscape integrated approach as it should be since their assessment frameworks are primarily private sector- led designs and financial metrics based- indicators are dominant.

The assessment results show that out of 21 indicators, including core and landscape dependent indicators in total 9 were determined as applicable, three were inconclusive, and 3 were defined as not applicable; likewise, out of 9 indicators defined as appropriate, 5 were described as required, two were recommended and 1 optional.

On the one hand, our results indicate that a potentially sensitive identified area is the main water body surrounding the estate; this means some investment activities to protect the water body need to be implemented. On the other hand, although Natural ecosystem protection is being run by the government, which means that the viticulture estate must join to the national efforts and expand the success of nationwide activities, it is essential to keep the water quantity by protecting water bodies and implementing an action plan in surrounding areas near these water bodies itself.

Furthermore, an increase in investment efficiency must be yielded by preparing an ecosystem restoration action plan

considering areas identified as important for biodiversity to reduce soil depletion and boost hydric natural regulation; therefore, the investment in this point must be included in the annual management plan and cooperation with local governmental institution also should be enhanced.

The management action plan must consider additional economic, technological, and social benefits for workers to boost the quality of life of harvesters and other annexed employees in the company. In addition, this action plan should include some parameters such as health and nutrition for workers and the worker's children to ensure a good quality and performance at work and school. It is ultimately essential to maintain a good quality of the grape-based products by using organic products as usual. This will help the viticulture estate achieve success and improve the quality of wine production even more.

Our two central core ecosystem pillar's prioritized results indicate that our metric related to total area (ha) and percentage (%) of each ecosystem type under protection is optimum with just one protected area at the local level (0.11 % of the total); thus, it was identified by setting a green color to it.

Natural ecosystem conversion is defined as high or critical since the country lost about 111,726.4 ha over the last 20 years; therefore, it is identified by setting a red color to it.

When defining our dependent indicators results in the ecosystem pillar, on the one hand, the total area (ha) under Restoration, disaggregated by ecosystem type and restoration type, is outlined and indicates that only a share (1.06%) of the total restorable area is restored. On the other hand, at the local level, the area (ha) and percentage (%) of land under Restoration within areas identified as necessary for biodiversity is also low since the company has only planted roughly 2 ha over the last 20 years. Therefore, both the local and national levels were defined in red. Water quantity was described as green in color.

Concerning our Human well-being pillar metrics such as percentage of poverty (Nationwide, 0.3%), percentage (%) of children that are undernourished (Nationwide, <2.5), percentage (%) of school-aged children (Nationwide, 2.7%), child labor(at local level, 0%), forced labor(local level, 0%), all in all, they were defined as red(critical), yellow(close to critical), green(No critical) and green respectively.

Regarding our production pillar indicator results, the metric average crop productivity (yield/ha) disaggregated by crop was 5Mt/ha; therefore, it is defined as green. Likewise, Our metric fertilizer use efficiency (quantity of product produced per unit of nitrogen, phosphorus, and potassium (NPK) use was 0.36, thus defined as green. Lastly, our metric, Land area(ha) under major crop that utilizes integrated pest management, and percentage (%) of total production area that this represents was 100 %.

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