RICE MILLING IN AMAGU COMMUNITY OF EBONYI STATE: HEALTH AND ECONOMIC IMPLICATIONS

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Abstract
Although Rice is the most economically important food crop in the world, its milling is always characterized with environmental and socio-economic problems. Convinced that Abakaliki Rice Mill was contributing to environmental degradation in Abakaliki Capital City, Ebonyi State Government in 2009, ordered for its relocation. This study, therefore, examined the economic effects of Abakaliki Rice Mill Company Ltd and its health implications on Amagu Community. The research employed surveyed instruments and hospital records. A total of 396 questionnaires were administered to residents in Amagu Community using clustered systematic sampling technique. The questionnaire had 8 variables each on the economic effects and health implications. The data on the econoi4ic effects were analyzed using Wilcoxon Ranks Signed Tests while Kruskal Wallis Test was used for data on health. The results revealed that whereas the rice mill has a significant positive economic effect (p value>0. 05), it has no significant health implications on the community, with p values; 0.579 and, Q.3]9>Q.Q5. Hence, the study recommended; cleaner production technology, tree planting, treatment of waste water before disposal, and banning of parboiling of paddy in the residential areas, safety practices, among others.
Keywords: Rice, Rice Milling, Abakaliki Rice, Amagu-Community, Ebonyi State

Introduction

Milling of rice is an important activity in food chain of the world economies. Rice feeds more than a third of the world's population (Khush, 1997); the predominant staple food in about 33 countries of the world including Nigeria (FAQ, 2004). About 85% of the total production of rice is meant for human consumption (Janick, 2002). About 90 - 95% of Nigerians consume rice and this cuts cross all economic classes where it is eaten in different recipes (Wudiri, 1992). According to Oguntade (2011), the rice milling industry in Nigeria is capable of contributing significantly to employment generation, economy boosting and food security [IRRI, 2014; World Rice Statistics, 2000]. It is an ingredient in medicine; it is used to treat stomach upset, heart burn and indigestion, breast cancer and warts.

Few decades ago, rice grains were processed at family level before cooking. Today due to industrialization and global competitive market trend, it has emerged as one of the major industrial activities in various scales to cater for the increasing population of large number of millers engaged in processing. Milling of rice has spread over in some states across the country.

Rice processing operations in rice production include parboiling, drying and milling. All operations except milling are done manually using hand tools (Autrey et al., 1984). The technologies for rice milling in tiny and small mills are mostly conventional in nature and are not oriented towards minimizing pollution by incorporation of in-plant pollution prevention and control measures. Milling of rice is a crucial post-production step in rice production. The objectives of milling are to get whole grain rice and preserve most of the rice kernels in their original shape and to remove the husk and the bran layers and to produce an edible, white or brown rice kernel free of impurities. In an ideal milling process this will result in the following fractions: 20% husk, 8-12% bran depending on the milling degree and 68-72% milled rice or white rice depending on the variety. Total milled rice contains whole grains of head rice and brokens. The by-products in rice milling are rice hull, rice germ and bran layers, and the brokens [EPA. (1995); FAO, (2004) IRRI, (2014)].

Pollution is particularly high in cleaning of paddy, parboiling of paddy and milling of rice. Primary and secondary cleaning of paddy gives rise to solid waste and fugitive emission in the work environment.The coal and husk generate fly, suspended particulate matter, smoke and oxides of carbon. According to Farouk, et al. (2006), rice milling may present a significant source of air pollution both on site and the surrounding locality resulting from releases of dust to the atmosphere from processing of the paddy or its by-products and this is a major environmental concern for rice mills. Others according to (Farouk et al., 2006), include high internal and external noise levels which may generate health hazards to the local community, odour form soaking reservoirs, as well as unmaintained mechanical devices which cause severe noise and dust levels thereby endangering health of residents. In the World over, the industrial sector has been responsible for a "significant percentage" of all environmental damage and pollution. Unlike most other countries such as Indonesia, China, India, and many other countries where rice production is produced on a large scale, the policy frameworks in Nigeria to address these environmental problems have not considerably shifted from the end-of- pipe approach and strong government intervention to cleaner production and market-based actions [EPA, (1995); FAO, (2004) IRRI, (2014)].

The first measures by the government of Nigeria to address pollution problems in the 1980s were through the introduction of regulations and control under the program of compulsory environmental sanitation and compliance with environmental laws. This command and control approach had not been successful in raising awareness on environmental management issues. It has rather resulted in a perception that environmental management meant high costs for both capital investments and operations and maintenance (cost centre). Hence, these mandatory measures have not succeeded particularly well in responding to the environmental problems [Geiser, (2001), Nigerian Orient News, (2010)].

The policy of cleaner production and market-based action has in most cases, ended up as blueprints in Nigeria. Most times instead of being progressive on environmental matters, Nigerian Government relapse back to the end-of-pipe approach and strong government intervention in environmental protection which are already facing out in the developed countries. For this reason, in the mid I990s, the Ministry of Environment started to apply mixed policies and instruments which integrate the mandatory approach, partnerships and voluntary programs, and market-based & economic instruments (Daramola, 2005; Nigerian Orient News, 2010).

Abakaliki is the largest producer of rice in Nigeria. The Abakaliki Rice Mill Company Ltd has over 5,000 workers, 2,500 rice milling machines, and a production capacity of more than 11,000 metric tonnes per month. Tonnes and tonnes of rice husks are produced every year as by product of rice processing at Abakaliki rice mills (Cohen, et al., 1998; Nigerian Orient News, 2010).

The by-products include both the solid and liquid waste such as the rice husk, bran, effluents from fuel and used water. The husks are dumped indiscriminately around the rice mills and they accumulate due to the numerous rice milling machines located in the area (Ekwe, 2012; Mba et al., 2009).

Again, noise of different decibels is generated from the rice milling operations and heat of high temperature comes from the parboiling operations. Most of the by-products abandoned in the husk dumps. They are occasionally set ablaze. Moreover, there is usually smoke emitted from the rice mill continually into the surrounding communities (Njoku et al., 2011).

Despite the magnitude of these wastes generated daily and the possible and adverse effects on the environment, no serious attempts have been made either for their effective utilization or safe disposal. During the rainy seasons, the husk dumps are washed off as waste water into nearby streams and creeks (Mba et al., 2009). Again, due to the presence of the industry, there is usually influx of people from different places within and outside Abakaliki who come to buy the finished rice for consumption and sales.

In line with a policy in 2009, geared towards making Abakaliki one of the cleanest cities in Nigeria by Ebonyi State Government and 2012 policy to boost industrialization in tandem with the 2011 policy of the Federal Government under former President Goodluck

Jonathan to boost agriculture, with great emphasis on rice production, the Abakaliki Rice Mill was slated for relocation to the newly established State's Rice Clusters situated at Iboko in Izzi LGA, Onu Igboji in Ikwo LGA, and Oso Edda in Afikpo South LGA selected from the senatorial zones of the State (Adie, 2012, Nigerian Orient News, 2010).

In response to the move for relocation, the rice millers and people of Amagu Community where the mill is located in 2012 rejected the decision for relocation; reasoning that the milling process does not pollute the environment and that it will bring hardship to the people; not just the owners and workers of the Abakaliki Rice Mill but also the generality of the Community and the state capital. This impasse culminated in a court case between the two parties.

The Challenge

Rice milling is said to have negative environmental effects which translates into economic drain and associated health problems. Ebonyi State, in 2009, complained of such due to the presence of Abakaliki Rice Mill. Moreover, stakeholders in the environments, always have divergent views on the positive and negative effects of rice milling. This situation, in most cases, affects the economic and health policies of the Government.

It was based on the opinion that the mill is polluting its capital territory and proning the area to environmentally related health problems that prompted the policy to relocate Abakaliki Rice Mill to presumed better places within the state; a situation that culminated into a legal battle between the stakeholders of the mill and the Ebonyi State Government. This calls for need to holistically investigate the economic effects as well as the health implications of rice milling using Abakaliki Rice Mill in Amagu Community as a case study.

Amagu Community (wherein Abakaliki Rice Mill Company Ltd is sited) as shown in figure 4 is located in Abakaliki Local Government of Ebonyi State. It is bounded to the North, by by Ebonyi L.G.A; to the East, by Edda and Okpuitumo communities and Ebonyi River; to the South, by Ezza North L.G.A and to the West, by the Izzi Unuphu (see fig. 3). Abakaliki on the other hand, is located between Latitudes 60 10”N and 60 20” N and Longitudes 80 00”E and 80 30” E in the derived savannah zone of Nigeria; with a landmass of approximately 5,935sq km. Ebonyi state is located in the Southeastern part of Nigeria; within the transitional belt between the rain forest and guinea savanna. It is bounded to the North by Enugu and Benue States; to the East by Cross River State; to the South by Abia State and to the West by Anambra State (see figure 2) (Ugo, 2003).

The study population is 33,284; 15835 males and 17449 females (NPC, 2006), 100 Rice Mill workers as well as hospital retrievals from the Health Department of Abakaliki.

The climate of Abakaliki is of Guinea-Savanah, and tropical rain forest recording both the dry season and the rainy season with the heat of the tropical sun, without rainfall and the severe North-East trade winds between December and April. Water in this period of the year is most often contaminated and breeds guinea worm (Ugo, 2003).

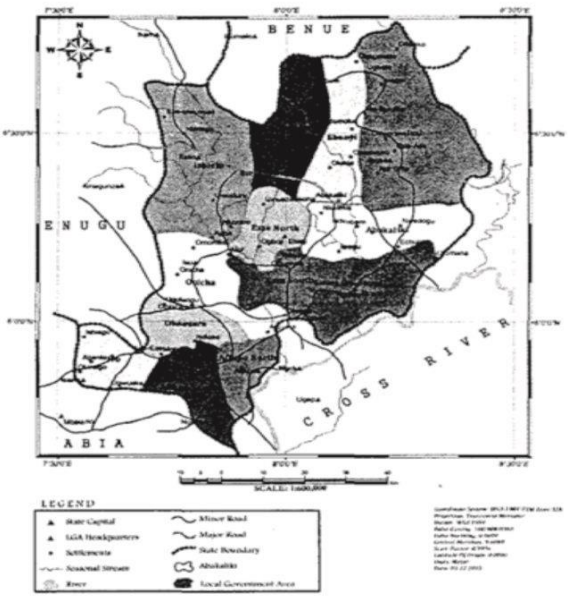


Figure 2: Map of Ebonyi State, Nigeria showing Abakaliki Source: GIS LAB, Geo-Planning Dept, KSU, Anyigba and Federal Surveys, Nigeria (1967)

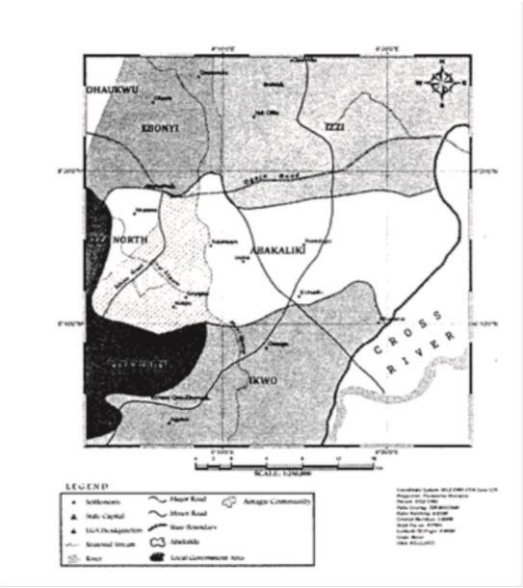


Figure 3: Map of Abakaliki L.G.A showing Amagu Community Source: GIS LAB, Geo-Planning Dept, KSU, Anyigba and Federal Surveys, Nigeria (1967)

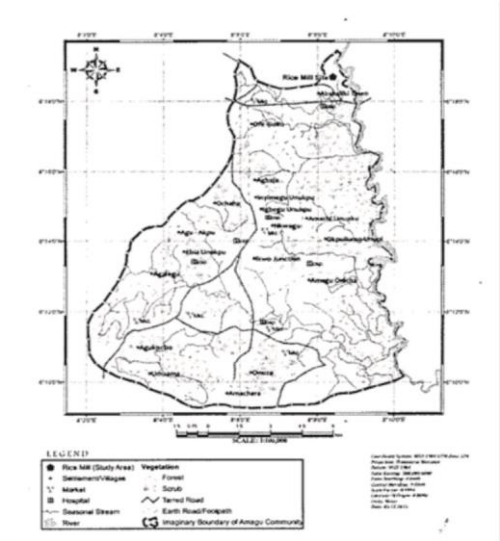


Figure 4: Map of Amagu Community showing the Mill Source: GIS LAB, Geo-Planning Dept, KSU, Anyigba and Federal Surveys, Nigeria (1967)

Secondly, the rainy season starts about May to October; with annual rainfall, between 200 and 185 centimeters; mean annual temperature of about 24°C and relative humidity of 60-80%. The rainfall pattern is bimodal; April-July and September-November with a short spell in August: Most of the agricultural activities are carried out then (Ofomata, 1975, Ugo, 2003).

The most outstanding of the water body is Ebonyi River with sandy deposits. The major water supply sources are wells, bore holes. The vegetation is characterized by the usual mixed rainforest and guinea savanna species of flora (Ofomata, 1975)

The main economic activity of Amagu community is rice cultivation and petty trading and civil service (Ugo, 2003).

Conceptual Framework

This work is based on the concept of sustainable development because it is the development that meets the needs of the present without compromising the ability of the future generation to meet their own needs. The concept stands on social, economic and environmental sustainability.

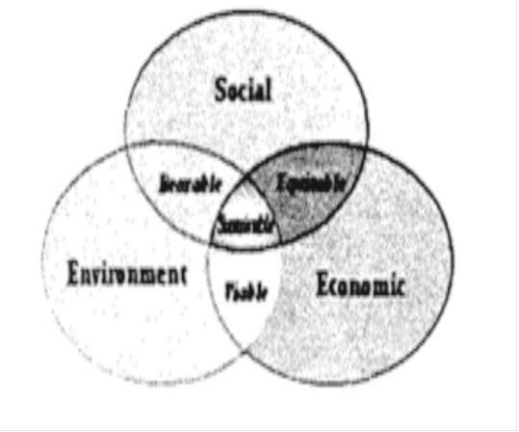


Figure 1: Scheme of sustainable development at the confluence of three constituent parts Source: Adams (2006)

The widely accepted definition of sustainability or sustainable development was given by the World Commission on Environment and Development in 1987. It defined sustainable development as

"forms of progress that meets the needs of the present without compromising the ability of future generations to meet their needs." Sustainability encompasses is the long-term maintenance of environmental, economic and social dimensions of responsibility and

encompasses the concept of stewardship (Adams, 2006).

Sustainability is important because all the choices we pursue and all the actions that we make today will affect everything in the future. We need to make sound decisions at present in order to avoid limiting the choices of generations to come. For instance, if clean water and good soil become scarce enough, all life on Earth can become extinct. Keep in mind that this does not just apply to soil and water but all elements of nature that are crucial to sustaining the Earth's equilibrium (Adams, 2006).

The definition of sustainable development requires that one should see the World, the environment and its resources as a system which connects space; and a system that connects time. Perceiving the World as a system over space, one may understand for example that air pollution from an area may affect air quality of another area and thinking of the world as a system over time can make one realize that farmland practices used years back can affect agricultural practice today; and the environmental policies we approve of today may have an impact on the environment in the future.

Sustainable development is based on environmental and economic objectives and there is need to conserve environment resources, biodiversity, and the same time uses the resources judiciously to achieve certain economic goals (Adams, 2006).

Sustainable development is therefore very vital in rice milling system. Herein, resources are utilized and processes are carried out. The resources in the context of this study are the human and natural vis-à-vis, the soil, water and air components, the human beings, the rice, the machines, the money to and fro the business of rice milling.

The government as well as the Rice Millers owes to the environment the responsibility of managing the environmental resources in such a way as to satisfy the needs of today without compromising the needs of future generation. When the both parties play their parts as pointed out in the course of managing the development, it will be said that the management and development are sustainable.

Methodology

The research methodology adopted for this work is the survey method and hospital records. A total of 396 questionnaires were distributed to the 9 villages that make up Amagu Community using clustered systematic sampling technique on the households. Systematic random sampling method was adopted in eliciting information from 100 Rice Mill workers/operators. The questionnaire contained two major sections. Section A on personal data of the respondents while section B contained variables Economic effects and health implications of the rice mill on Amagu Community.

Data on the monthly disease surveillance from 2010 to 2014 was collected from the health department of Abakaliki L.G.A. The data focused on the environmentally-induced health problems like Asthma, typhoid, cholera, diarrhea and malaria, etc. Whereas the questionnaire data was analyzed using Wilcoxon Signed Ranks Test; the health data were analyzed using the Kruskal Wallis test.

Analysis

Table 1: Data on Economic Effects of Abakaliki Rice Mill on Amagu Community

Description	Agreed	Disagreed	Unsure
Abakaliki Rice is the major type of Rice in Amagu	379(95.7%)	9(2.3)	8(2.0)
Abakaliki Rice Mill creates job opportunities	378(95.5%)	3(0.76)	15(3.8)
Rice husks from the Rice Mill improves crop yield	338(85.6%)	13(3.0)	45(11.4)
Rice Husks are used as fowl feeds	301(76%)	32(8.0)	63(16.0)
Rice husks is used as an alternative source of energy	328(83%)	55 (13.7)	13(3.3)
Abakaliki Rice Mill is a source of your revenue	350(88.4%)	12(3.0	37(9.3)
Abakaliki Rice Mill boosts development	356(88.9%)	6(1.5)	37(9.3)

Abakaliki Rice Mill boosts your rice farming	346(87.4%)	20(5.0)	30(7.6)
Total	2776	150	248

Source: Author's Field Survey 2015

From table 1 which is on the economic effects of Abakaliki Rice Mill on Amagu Community, 87.6% of the respondents agreed to the positive indices. This implies that almost all the respondents (i.e. more than 5/6 of the sampled population), were of the opinion that Abakaliki Rice Mill had positive economic effect on Amagu Community.

Table 2: Data on Health Implications of Abakaliki Rice Mill on Amagu Community

Description	Agreed	Disagreed	Unsure
You feel catarrh, headache, sneeze etc more in Amagu	167(42.2%)	199(50.3)	30(7.5)
The Rice mill smoke impairs your vision; suffocated you	151(38.1%)	199(50.3)	46(11.6)
Drinking Ebonyl River gives you stomach upset	104(26.2%)	125(31.6)	167(42.2)
Effluents(wastes) from the rice mill kill your fishes	49(12.4%)	197(49.7)	150(37.9)
There are much mosquito bites in Amagu	240(60.6%)	129(32.6)	27(6.8)
You feel skin and eye irritation more in the village	164(41.4%)	202(5 1.0)	30(7.5)
You feel hotter and more uncomfortable in Amagu	225(56.8)	152(38.4)	19(4.8)
The mill should be relocated due to health implications	33(8.3)	348(87.9)	15(3.8)
Total	**1133**	**1551**	**484**

Source: Author's Field Survey 2015

From table 2, whereas 3 5.7% of the respondents agreed to the negative health indices postulated, 48.9% disagreed. This implies that greater number of the respondents were of the view that the rice mill had no significant health implication on Amagu Community.

Table 3: Data on Health Implications of Abakaliki Rice Mill on its Workers/owners

Description	Agreed	Disagreed	Unsure
You feel catarrh, headache, sneeze etc more in Amagu	257(64.9%)	139(35.1)	0(0.0)
The Rice mill smoke impairs your vision; suffocated you	139(35.1%)	99(25)	158(39.9)
Drinking Ebonyl River gives you stomach upset	119(30%)	99(25)	178(45)
Effluents(wastes) from the rice mill kill your fishes	40(10%)	198(50)	158(40)
There are much mosquito bites in Amagu	278(70.2%)	59(14.9)	59(14.9)
You feel skin and eye irritation more in the village	257(65%)	119(30)	20(5)
You feel hotter and more uncomfortable in Amagu	297(75%)	99(25)	0(0.0)
The mill should be relocated due to health implications	0(0.0)	396(87.9)	0(0.0)
Total	**1387**	**1208**	**573**

Source: Author's Field Survey 2015

Table 3 shows that about 44% of the workers/owners of the rice mill greed to the negative health indices, while 38% disagreed. But 18% were not aware of the health implications of the rice mill. This suggests that the significant level of the health implications was not enough as to adjudge the health situation bad.

Table 4: Data on the Affected and Unaffected Target Population in Amagu Community environmental-related health problems (2010-2014)

No of People Affected						No of People Unaffected					
2010	**2011**	**2012**	**2013**	**2014**	**Total**	**2010**	**2011**	**2012**	**2013**	**2014**	**Total**
48	118	239	118	694	**1217**	312	262	141	348	25	**1298**
70	121	156	81	714	**1142**	280	249	214	39	368	**1150**
71	126	196	399	792	**1584**	229	176	176	581	108	**1270**
82	95	25	102	268	**572**	128	136	206	48	332	**850**
51	137	82	359	60	**689**	89	18	73	517	140	**837**
96	122	108	464	534	**1324**	154	162	176	511	486	**1489**
141	208	121	756	693	**1919**	264	230	317	194	300	**1305**
48	142	138	484	764	**1576**	332	241	245	65	328	**1211**
44	131	167	411	536	**1289**	196	119	83	160	169	**727**
58	32	85	571	13	**759**	62	108	55	403	183	**811**
111	26	168	479	197	**981**	90	189	47	130	353	**809**
44	76	153	649	150	**1072**	86	73	3	267	320	**749**
864	1334	1638	3263	3322	**14124**	2222	1963	1736	4873	5415	**12506**

Source: Clinical Records on Environmentally-Related Health Cases from Health Facilities in Abakaliki L.G.A (2014); tabulated and computed by the Author 2015

Table 5: Total Diseases Surveillance from Year 2010 to 2014

Diseases	**Months (2010-2014)**												
	J	**F**	**M**	**A**	**My**	**J**	**J**	**Au**	**S**	**O**	**N**	**D**	**Total**
Diarrhea	195	90	76	43	35	56	106	55	32	27	29	40	**784**
Pneumonia	13	58	30	14	6	13	20	49	44	13	14	8	**282**
Malaria	482	566	668	193	56	431	530	650	460	67	87	102	**4292**
Typhoid	4	0	18	18	0	34	37	10	0	3	67	0	**191**
Asthma	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Cases	694	714	792	268	97	534	693	764	536	110	197	150	**5549**

Target	929	1082	900	600	200	1020	993	1092	705	195	550	470	**8736**
Population													

Source: Clinical Records on Environmentally-Related Health Cases from Health Facilities in Abakaliki L.G.A (2014); computed by the Author (2015).

From table 4 which is on diseases prevalence, 53% of the target population was affected while 47% was not affected by the environmental-related health problems. This suggests that the presence of the Abakaliki Rice Mill is contributing the health problems in Amagu Community. From table 5, 77.3% of the selected health problem was malaria; implying that the environmental sanitation of the area is poor. To ensure that the conclusions are not based on mere observations, opinions and secondary data from hospital retrievals, the data was subjected to Wilcoxon Signed Rank Tests; for the questionnaire data and Kruskal wallis test for the prevalence rate in order to test the two hypotheses formulated. This paper took a look at the economic effects and health implications of Abakaliki Rice Mill Company Ltd on Amagu Community, Ebonyi State Nigeria. The test revealed that 86.7% of the respondents agreed to the positive statements on the economic effects of Abakaliki Rice Mill; suggesting that Abakaliki Rice Mill Company Ltd. has a significant economic effect on Amagu Community. Again, it discovered that the economic benefits were the strong basis upon which the greater number of the residents accepted the current location. On the other hand, the tests also revealed as follows: (1); that there is no significant difference between those affected and those who were not affected by the prevalent cases and (2); that there are no significant health implications of the rice mill on those that work in the rice mill, (3); that there are no significant health effect on the Amagu community. All these tallied with the responses from the questionnaires. All these point to the fact that Abakaliki Rice Mill Company Ltd has no significant health implications Amagu Community.

The following recommendations are plausible:

Cleaner production technology should be pursued to tackle solid waste and fugitive emissions; banning of parboiling of rice within the residential areas.

Rice mill wastes should be treated before disposal and a waste treatment plant should be incorporated in the company layout.

Rice husk energy-generating plant should be established for economic reasons.

Proper sensitization for attitudinal change on waste disposal and other safety practices in the Rice Mill Complex should be carried out by the relevant agencies.

Wearing of nose and eye protective devices should be made compulsory in the Rice Mill for the mill workers and the other users should be sensitized on the needs.

Mechanized and less dehumanizing method of husk disposal should be adopted for job vacancies.

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