1. Project Data

<table>
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<tr>
<th>Project ID</th>
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<tr>
<td>P100455</td>
<td>CN-Henan Ecological Livestock Project</td>
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<table>
<thead>
<tr>
<th>Country</th>
<th>Practice Area(Lead)</th>
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<td>China</td>
<td>Agriculture</td>
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<tr>
<th>L/C/TF Number(s)</th>
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<th>Total Project Cost (USD)</th>
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<td>IBRD-79090</td>
<td>31-Dec-2015</td>
<td>160,000,000.00</td>
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<th>Closing Date (Actual)</th>
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<td>27-May-2010</td>
<td>31-Dec-2015</td>
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| Original Commitment | 80,000,000.00 | 0.00 |
| Revised Commitment  | 78,570,099.79 | 0.00 |
| Actual              | 78,570,099.79 | 0.00 |

Sector(s)
Fisheries(46%):Livestock(47%):Public Administration - Agriculture, Fishing & Forestry(4%):Agricultural Extension, Research, and Other Support Activities(2%):ICT Services(1%):Public Administration - Information and Communications Technologies(%):Other Information and Communications Technologies(%)

Theme(s)
Pollution management and environmental health(77%):Other rural development(16%):Administrative and civil service reform(3%):Rural services and infrastructure(3%):Rural policies and institutions(1%)

2. Project Objectives and Components

a. Objectives

The Loan Agreement for the Henan Ecological Livestock Development Project stated that the project’s objective was “to improve environmental health management practices on targeted livestock farms in the Yellow River Belt in Henan Province of the Borrower” (Schedule 1). This was identical to the development objective stated in the Project Appraisal Report (PAD). The objective in the Loan Agreement is used in this Review’s assessment of the extent to which the project achieved its objective.
b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Components

The PAD partitioned the project into three components. The activities in these components and their costs are summarized below. The appraisal costs shown do not include physical and price contingencies which totaled US$18.28 million. The actual costs do not include the front end IBRD fee (US$0.20 million).

**Component 1. Institutional Strengthening, Training and Technical Support** (appraisal cost US$3.37 million; actual cost US$3.25 million). This component’s aim was to improve the technical understanding and institutional management capacity at the province, municipal and county levels of on-farm management of livestock waste processing through, inter alia, the strengthening of public institutions, provision of training, technical assistance and management support to livestock farms in the areas of animal health and waste management, in addition to carrying out awareness raising activities and establish a Geographic Information System (GIS). Activities were to be financed through two subcomponents: (a) Strengthening of Public Institutions; and (b) Farmer Training, Technical and Farm Management Support. The two sub-components would include technical assistance, technical training, awareness raising, and investment in technical support systems for animal health management (PAD, paragraph 19).

**Component 2: Environmental Management in Existing and New Farms and Livestock Parks** (appraisal cost US$145.10 million; actual cost US$150.12 million). The aim of this component was to construct and equip facilities in small scale and medium size beneficiary farms/parks for waste minimization, animal health, waste management and waste treatment, and for demonstrating ecologically standardized livestock farming in selected beneficiary farms/parks, including the provision of civil works, equipment and technical assistance for construction design and supervision. It had the following subcomponents: (a) Waste Minimization and Animal Health Infrastructure; (b) Waste Management Infrastructure; (c) Waste Treatment Infrastructure; (d) Production Infrastructure Support to New Livestock Parks; and (e) Construction Design and Supervision. Financing will be provided for civil works and equipment to improve waste management and farm productivity (PAD, paragraph 20).

**Component 3: Project Management, and Monitoring and Evaluation** (appraisal cost US$3.83 million; actual cost US$5.79 million). Strengthening institutional capacity at the province, municipality and county levels to implement the project and to establish and implement an effective monitoring and evaluation system through, inter alia, the provision of equipment, materials, vehicles, training and technical assistance, including establishment of a computerized Management Information System (PAD, paragraph 21 and Annex 1).

d. Comments on Project Cost, Financing, Borrower Contribution, and Dates

**Project Costs:** The total project cost at appraisal was US$170.78 million but the actual cost was US$159.35 million. The reduction was largely due to changes in the exchange rate over time between the Chinese RMB and the US dollar.

**Financing:** The planned sources of finance at appraisal and the actual financing when the project closed were as follows: IBRD (US$80.00 million at appraisal compared with actual financing of US$78.57 million) and project beneficiaries (US$89.41 million at appraisal compared with an actual amount of US$77.50 million).

**Borrower Contribution:** The Government of the People’s Republic of China committed US$1.37 million to the project at appraisal but eventually contributed US$3.28 million when the project closed.

**Dates:** The project was formally approved on May 27, 2010 and closed as planned on December 13, 2015. The mid-term review (MTR) was scheduled for June 3, 2013 but was actually held on November 25, 2013.

### 3. Relevance of Objectives & Design

a. Relevance of Objectives

The project’s objective was “to improve environmental health management practices on targeted livestock farms in the Yellow River Belt in Henan Province”. According to the ICR this province has a population of about 100 million and is one of China’s most densely populated and poorest provinces. Henan’s GDP growth was reported to have been 10.1 percent in 2012 (*The China Perspective*). Agriculture is a dominant sector in Henan province which ranks third in China’s density of livestock numbers and fourth in total livestock production. Livestock account for about half of annual income for local farmers (ICR, paragraphs 1.1.2 and 1.1.3). As the PAD noted, although expansion of livestock
production was seen as an important generator of rural income, its rapid expansion also posed a threat to the environment and to public health if preventive and mitigating measures were not taken (PAD, paragraph 2). Hence a project with the objective of supporting an environmentally friendly approach to growth of the livestock sector in Henan was substantially relevant to Henan’s future sustainable economic growth and social development. An environmentally sound project was also consistent with the World Bank’s Country Partnership Strategy (CPS) for China for 2006-2010 when the project was designed and appraised and also relevant to the CPS for 2013-2016 during which time the project closed.

Moreover the sustained development of the livestock sector was relevant to the Chinese Government’s 11th and 12th Five Year Plans which, respectively, included social infrastructure and enhancement of rural livelihoods, environmental sustainability, sustainable growth, and improved quality of life (ICR, footnote 19). Henan’s provincial government was also focused on sustainable development of the livestock sector since this would be a foundation for the growing livestock products processing industry. In this respect the Chinese and Henan provincial governments were concerned about reduced environmental pollution from intensive livestock production systems, a cleaner village environment with improved livestock waste management, private benefits of project farms/parks resulting from improved feed management and better animal health; and improved capacity and competitiveness of small-holder cooperatives (ICR, paragraph 3.1.1).

b. Relevance of Design

The project's activities, namely the two operational components; the first (institutional strengthening, training and technical support) and the second (environmental management in existing and new farms and livestock parks) were substantially relevant to the project’s development objectives. The first, as the PAD noted, was relevant to improving the capacity of public institutions to support the development of the livestock industry and to regulate, monitor and evaluate the environmental impacts of the industry; and finally to assist Henan province and its municipalities and counties to disseminate new technologies in livestock waste management and ecologically sustainable animal husbandry management models to cooperatives and private enterprises (Annex 4, paragraph 1). The second component was relevant to providing support to eligible livestock farms and parks to build infrastructure for waste minimization, management, and treatment as well as to train farmers in the operation and management of livestock waste infrastructure (Annex 4, paragraphs 2 to 4). However, it should also be noted that this project was being implemented in the context of efforts by the Henan provincial government to encourage the transformation of dairying and cattle fattening from small traditional "backyard operations" to "ecologically standardized" large livestock farms or parks that were amalgamations of smallholder operations into groups such as cooperatives using land provided by the government (ICR, paragraph 1.1.5). Although the project's design was based on this transformation in the structure of livestock farming there was no evidence in the ICR that the transformation was sustainable in institutional, financial or economic terms. Indeed, as the Section 4 of this Review points out, only about 62 percent of project enterprises remained in operation during the last year of project implementation which raised questions about the advisability of designing the project around the large transformed enterprises.

While the central government as well as Henan’s state and municipal governments, made commitments to finance the project, day to day responsibilities for project management, administration and implementation were delegated to county governments. As the ICR noted, despite the positive efforts of the county project management offices (CPMOs) during the final year of the project, there were considerable delays in disbursement and implementation during the early years of the project which reflected shortcomings in the performance of the CPMO’s during most of the project’s implementation including a substantial delay in the submission of an end of project M&E report (ICR, paragraph 5.2.3). The design of the project's management arrangements in the field was clearly less than adequate.

Another shortcoming in the project's design was the results framework in Annex 3 of the PAD because it did not adequately reflect the project’s design and theory of change. The framework was merely a listing of objectives, sub-objectives and their indicators. It failed to show how institutions such as the CPMOs would work with farming enterprises to convert project inputs into intermediate and final outcomes through various results chains. For example, the results framework made no reference to a core feature of the project's theory of change, namely that improved waste management systems would improve soil organic matter, increase soil moisture retention and the substitution of organic fertilizers for inorganic fertilizers which would have been used in the absence of the waste management program. The ICR did, however, mention these aspects of the project's theory of change in the context of its analysis of the project's efficiency (paragraph 3.3.3).

Overall the relevance of design was rated modest.
4. Achievement of Objectives (Efficacy)

Objective 1

Objective
There was one unique objective for this project, namely "to improve environmental health management practices on targeted livestock farms in the Yellow River Belt in Henan Province of the Borrower"

Rationale
This Section will first assess the efficacy of the investments that established an enabling environment for improvements in environmental health management practices on targeted livestock farms, namely the project investments and their outputs. Second, this section presents an assessment of the improvements in environmental health on target livestock farms and a summary of the perception by people in villages surrounding the target farms of the impact of the project on improving environmental quality, namely the project outcomes. These investments and outcomes, summarized below, were gleaned from various parts of the ICR and discussions with the Bank’s project team.

Investments

1. Institutional Capacity in Provincial, Municipal and County Governments.

(a) Training aimed at improving capacity of public institutions [ICR, paragraph 3.2.3 (a)]:

- Animal Husbandry Bureau staff were trained in spatial planning for livestock sector development including GIS data acquisition, analysis and utilization, and on-farm nutrient balance accounting.
- Animal Husbandry Bureau and Environmental Bureau staff were trained in measuring and evaluating the livestock sector’s impact on the environment including, sample evaluation, data analysis, environmental laws and regulation enforcement.
- A total of 29,668 person/days of training were provided against the appraisal target of 29,160 person in various subject areas such as feed quality control, mineral/nutrient accounting systems, environmental M&E, and environmental impact awareness

(b) Technical Support to provincial, municipal and county governments [ICR, paragraph 3.2.3 (b)]:

- Development and distribution of a “Guidance Manual for Waste Management on Project Farms/Parks”
- Eight applied research studies on the introduction of relevant technologies for ecologically friendly livestock production.
- GIS development and application to improve and strengthen the capacity of relevant public institutions to serve the project.

(c) Verification of Technical Capacity of Government Institutions [ICR, paragraph 3.2.3 (c)]

- Three surveys of trainees were conducted by the Social Resettlement Research Institute of North China University of Water Resources and Electric Power in August 2013, January 2015 and January 2016 to assess the capacity improvement of public institutions at the provincial, municipal, county and household levels in accordance with the survey and assessment methods reviewed by the Bank task team in August 2013, January 2015 and January 2016. The end of project survey in 2016 was based on a total of 687 questionnaires distributed to and completed by Project Management Offices and officials (117) and sampled households (570).
- The end of project survey was used to test whether “improved capacity of public institutions to facilitate environmentally sound livestock industry development” defined in the PAD (ICR, paragraph 1.2.2) as the first of three PDO indicators had been achieved. This Review does not regard this indicator as a PDO indicator because it does not measure the achievement of the PDO. Nevertheless, improving the capacity of public institutions to facilitate the achievement of the project’s objective was an important part of the project’s design and a crucial intermediate outcome for the project’s final outcomes.
According to an independent survey in 2016, the technical training program which focused on nine subjects related to various aspects of livestock and environment management was accorded a satisfactory rating (ICR, page 16, footnote 23).

2. Construction of Infrastructure (based on ICR, Annex 2)
(a) Waste Minimization and Animal Health Infrastructure

- Silage Pits - 1,114 cubic meters compared with a target of 935 cubic meters
- Feed grinders – 580 compared with a target of 417
- Maize and wheat hay and straw cutters – 1,387 compared with a target of 417
- Pump rooms – 6,264 cubic meters compared with a target of 4,462
- Pumps – 580 compared with a target of 408

(b) Waste Management Infrastructure

- Calf sheds – 5,640 compared with a target of 3,912
- Cow beds – 66,426 compared with a target of 45,928
- Feeding systems in pig sheds - 4,500 achieved but no target
- Covered sewage drains – 403,000 meters compared with a target of 310,000 meters
- Mechanical manure scrapers 580 compared with a target of 469
- Hand carts – 6,016 compared with a target of 4,808

(c) Waste Treatment Infrastructure

- Concrete Manure Pads – 251,000 square meters compared with a target of 180,000 square meters
- Liquid waste collection tanks – 261,000 cubic meters compared with a target of 202,000 cubic meters
- Tanker trucks – 1,160 compared with a target of 850

(d) Production Support to New Livestock Parks

- Milking Stations – 30,000 square meters compared with a target of 27,700 square meters
- Milking Machines – 66 sets compared with a target of 58 sets
- Milking tanks – 66 compared with a target of 57
- Movable Milking Machines – 132 compared with a target of 115
- Water Heaters for Flushing Milking Equipment – 66 compared with a target of 58
- Landscaping/afforestation – 1,927,000 square meters compared with a target of 1,258,000 square meters

(e) Number of Farms Supported by the Project

- The total 468 farming establishments which participated in the project were made up of 194 farmer cooperatives (41.45%), 173 sole proprietorship companies (36.97%) and 101 joint stock companies (21.58%). Among these forms of management 1,434 farmers households participated in the project including 919 as dairy enterprises, 439 beef fattening enterprises, and the remaining 76 were pig farms (ICR, Annex 10 and Social Impact Assessment Completion Report, page 76).
- The table below shows that, although 95 percent of pig farms that had received project support were still “in operation” during the year that the project closed (2015), only 75 percent of dairy farms and 49 percent beef fattening enterprises were “in operation” (ICR, Annex 10 and Social Impact Assessment Completion Report, page 133). The high rate of attrition for beef fattening enterprises was consistent with the average fattening period achieved for beef cattle of 97 days which was only 2.6 percent less than the target of 100 days. For pig farms the average fattening period was reported to have been better at 139 days or 13.2 percent less than the target. Hence the very low attrition rate for pig farms is well explained by the easy achievement of the lower fattening period. The considerable attrition of beef cattle fattening enterprises “in operation” is not explained in the ICR but in an exchange between IEG and the project team it was explained that the attrition for dairy and cattle fattening was due to economic reasons listed below.
For all farms participating in the project, the SIA Completion Report found that only 62 percent of “Farms (were) operating and maintaining improved livestock production and waste management infrastructure” (intermediate outcome indicator 5) which was much less than the actual achievement of “100 percent” stated in the ICR and also less than the original target of 80 percent (ICR, Data Sheet, page viii). Intermediate outcome indicator 6 (“Farms that meet the required livestock waste management/environmental regulations”) which had a target of 60 percent was apparently achieved by the average farm depending on the definition of “in operation”. However the Data Sheet stated that the actual achievement for this indicator was 98 percent (ICR, page viii) which is not consistent with the information presented in the table below.

The project team advised IEG that the reasons for the considerable attrition/withdrawal rates for the dairy and beef fattening farms was due to various reasons such as lower sales prices, shortage of working capital and fear of epidemic animal diseases.

<table>
<thead>
<tr>
<th>Type of Farm</th>
<th>Dairy Farms</th>
<th>Beef Fattening Farms</th>
<th>Pig Farms</th>
<th>Total Farms</th>
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<tr>
<td></td>
<td>(number and percent of farms)</td>
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<tr>
<td>Total Supported by the Project</td>
<td>165</td>
<td>260</td>
<td>43</td>
<td>468</td>
</tr>
<tr>
<td>Farms not in Operation in 2015</td>
<td>41</td>
<td>134</td>
<td>2</td>
<td>177</td>
</tr>
<tr>
<td>Percent of Farms not in Operation in 2015</td>
<td>24.8%</td>
<td>51.5%</td>
<td>4.7%</td>
<td>37.8%</td>
</tr>
<tr>
<td>Percent of Farms in Operation in 2015</td>
<td>75.2%</td>
<td>48.5%</td>
<td>95.3%</td>
<td>62.2%</td>
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</tbody>
</table>

Outcomes
1. Nutrient Output Reduction on Farms
“Nutrient output reduction on project farms” (PDO indicator, ICR, paragraph 1.2.2) was achieved following implementation of improved livestock management and environmental practices.
(a) The project measured the nutrient release rates as the change in the release of nutrients (nitrogen and phosphorus) to the environment on target animal farms/parks as a percentage of the total nutrient content in the feed/forage consumed on target animal farms/parks between the start and the end of the project. The ICR reported (based on information from the Provincial Project Management Office or PPMO) that a weighted average of the reduction in the nutrient release rate on all animal farms/parks at the project’s close was 18.74 percent compared with a target reduction in release rate of 15 percent established at appraisal.
(b) The Bank’s project team noted that the basis for the weighted average among the various types of animal production farms/parks supported by the project could not be obtained from the PPMO. However, the ICR provided the weighted average nutrient release levels for the three types of livestock production at the baseline, at the end of the project and the change between the two – see table below (ICR, paragraph 3.2.4). The table shows that the decline in the nutrient release rate on farms ranged from a low of 14.95 percent for phosphorous on dairy farms to a high of 26.72 percent for nitrogen on pig farms.

<table>
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<tr>
<th>Nutrient Type</th>
<th>Baseline release rate (%)</th>
<th>End project release rate (%)</th>
<th>Reduction release rate (%)</th>
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<tr>
<td>Nitrogen</td>
<td>48.16</td>
<td>38.46</td>
<td>14.59</td>
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<tr>
<td>Phosphorus</td>
<td>48.36</td>
<td>41.13</td>
<td>19.62</td>
</tr>
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</table>

2. Perception of People in Nearby Villages on Pollution Changes
“People in villages surrounding the livestock farms perceive that the quality of their living environment has improved due to the project” (PDO indicator – see ICR, paragraph 1.2.2) was fully achieved based on the following evidence:
(a) A comprehensive survey conducted by an independent institution at the project’s close found that between 87 and 100 percent of the surveyed households perceived that the quality of the living environment had improved due to the project which was far higher than the target value of 60 percent target established at project appraisal (ICR, paragraph 3.2.5)
(b) Indicators of the quality of the environment in the survey included: (i) discharged waste amount from project farms/parks; (ii) change in number of fly, mosquito, bed-bug and flea; (iii) change of the surrounding environment as a result of the project; (iv) noise and dust pollution caused by project implementation; (v) odor impact before and after the project construction; and (vi) impact on water source before and after the project construction (ICR, paragraph 3.2.5)

In summary this Review concluded that the project had achieved its objective of improving environmental health management practices on targeted livestock enterprises in the project area. The efficacy of the project’s outcome is therefore rated substantial.
5. Efficiency

The PAD noted that the project was expected to have multiple benefits at the farm/park, local, and regional levels. Some of the benefits of the improved livestock waste management would be public goods that accrue directly to livestock farmers because, to a significant extent, farmers adopting improved waste management techniques were subsidizing the welfare of people in neighboring villages. Therefore the estimates of the financial internal rates of return (FIRR) for seven farm models were based on the farmers bearing the full cost of the improved waste management systems and also on the basis that farmers were subsidized because their investments created benefits for society as a whole. The subsidy (51 percent of the investment costs for waste management – see PAD, page 40) provided farmers with an incentive to undertake these investments. Hence FIRRs for the farm models were presented in the PAD and the ICR “without” and “with” the subsidy.

Analysis in the PAD

Estimates in the PAD of the project’s expected economic and financial rates of return were based on seven representative livestock production models expected to be implemented in the project which included dairying and beef cattle models with variable herd sizes, and quite a large pig farming enterprise.

- Estimated economic rates of return (ERRs) over a period of 20 years ranged between 13.0 percent for a 200 head beef cattle fattening farm and 17.8 percent for the 5,000 head pig farm. The weighted average economic rate of return for the seven models was estimated to be 13.9 percent. These estimates accounted for the benefits and costs of pollution control activities.
- The estimated FIRRs without the subsidy ranged from 9.6 percent for a 100 head dairy enterprise and 12.6 percent for a 5,000 head pig production enterprise. With a subsidy the FIRR for the seven models ranged from 14.2 percent for a 200 head beef cattle fattening farm and 25.6 percent for the 500 head dairy farm using organic fertilizer.

Analysis in the ICR

The ICR estimated the rates of return for the above-mentioned farm models (with some changes in the size of two enterprises) using real data collected from the project activities.

- For a 500 head dairying enterprise producing and using “granule” organic fertilizer (selling part of it to other farmers) achieved an ERR of 9.1 percent and for the same herd size on farms that were only composting organic fertilizer the ERR was estimated to be 22.1 percent. The difference between the rates of return were because the production of granule organic fertilizer involved a high investment cost and relatively low sale prices for this processed fertilizer compared with the relatively economical alternative composted fertilizer production in the second case. The weighted average ERR for all seven models was 16.3 percent.

- The FIRRs without the subsidy ranged from 8.5 percent for a 500 cow dairying enterprise using organic fertilizer and 19.7 percent for a 300-500 cow dairy enterprise. With the subsidy the FIRRs ranged from 13.9 percent for a 300-500 beef cattle fattening enterprise to 31.6 percent for 500 cow dairying enterprise.

Sensitivity Analysis

The analysis in the PAD indicated that the profitability of the various dairying and beef cattle fattening models were sensitive to quite small variations (5 percent) in milk yields and fattening periods. The ICR does not mention this substantial sensitivity but, as mentioned in Section 5, the lack of sustainability of dairying and cattle fattening enterprises was due to economic reasons. This Review agrees with the PAD (paragraph 47).that such level of sensitivity places considerable importance on efficient farm management. It also places pressure on the efficiency of the cooperatives.

Project Management Costs

One significant aspect of the project’s activities was the 178 percent increase in project management costs. The project team explained that the costs were covered by various levels of government but costs could have been underestimated at appraisal. However, despite the large increase in project management costs, when the project closed management costs were only 1.8 percent of total costs.
a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

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<th>Rate Available?</th>
<th>Point value (%)</th>
<th>*Coverage/Scope (%)</th>
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</thead>
<tbody>
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<tr>
<td></td>
<td></td>
<td></td>
<td>□ Not Applicable</td>
</tr>
<tr>
<td>ICR Estimate</td>
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<td>16.30</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>□ Not Applicable</td>
</tr>
</tbody>
</table>

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

The relevance of the project's objective was rated high. The relevance of this project's design was rated modest because the design of the project's implementation arrangements along with the inexperience of staff in the county project management offices were weak and inexperienced. In addition the results matrix did not adequately reflect the theory of change in this large and complex project and it was not amended. Efficacy and efficiency were both substantial. In summary the Henan Ecological Livestock Development Project had minor shortcomings and its outcome is therefore rated satisfactory.

a. Outcome Rating
   Satisfactory

7. Rationale for Risk to Development Outcome Rating

The ICR noted that, rather than this project being a traditional investment project for increasing livestock production, it was a large "pioneer" project for the livestock sector in China focusing on environmental issues. It was anticipated that the “best practice methodologies” tested in this project would be adopted in other parts of China (ICR, para 3.1.1). The ICR also stated that “Henan province has decided to launch preparation of a new Bank financed livestock development project. Though still at its initial stage, the new project would focus on development of ecological livestock, livestock sectoral value chain and product safety in northern Henan” (paragraph 2.5.6). These are heartening endorsements of the project and its results so far and also indicate that risks listed in the PAD’s Risk Matrix did not appear as major concerns during implementation. Nevertheless, the ICR specifically mentioned a number of institutional and practical farm level risks to sustainability. On the institutional side environmental laws and regulations are inconsistently enforced, government committed services to the project farms/parks are inadequate; O&M costs are beyond the farm owners’ willingness to pay; and (d) farming businesses are dropping out of livestock production for economic reasons (paragraph 4.1). At the farm level the ICR noted that “a number of issues identified by the Bank supervision missions may jeopardize the demonstration function of some project farms/parks such as improperly constructed infrastructure; no or irregular operation of the self-propelled manure turning machine; damaged or non-operational waste treatment facilities; and transport of fresh manure out of farms without composting (paragraph 4.2).

However there are two related issues that are causes for concern with regard to the risk that the development outcomes will be sustained. First, the PAD mentioned the high sensitivity of rates of return to relatively small variations (5 percent) in milk yields and cattle fattening periods. This is not discussed as a risk in the ICR. Assuming that climatic variations will not have major effects on milk yields or fattening periods for beef cattle and pigs because most animals are housed in sheds, these risks will typically need to be addressed by improving technologies (e.g. good quality feed, high reproductive rates) and sound farm management standards (e.g. animal comfort, disease control). While not impossible to address, these improved technologies and sound management standards will require strategic investments and comprehensive training. If those investments and training are not effective the risk of the project’s sustained development outcomes could be substantial.

The second issue is the attrition of farms still operating waste management practices during the last year of the project’s implementation (mentioned already in Section 4 of this Review). The project task team advised IEG that “It happens in China’s animal husbandry sector that some farms may not be in operation in particular years due to various reasons - lower sales prices, shortage of working capital, fear of epidemic animal diseases”. Arguably, based on the sensitivity of the rates of return for project enterprises to variations in milk yields and fattening periods there is a high risk that these enterprises would have a reduced incentive to implement waste management practices if milk yields and fattening
periods were below expectations. This reduced incentive would be magnified if enterprises were also faced with other factors such as lower sales prices, short of working capital, fear of epidemic animal diseases. Hence there were many reasons why 38 percent of project enterprises were not "in operation" during the last year of the project which would have had a serious impact on the sustainability of the project.

Overall the project risks are rated substantial because the analysis of efficiency noted the considerable potential detrimental impact of small fluctuations in milk yields and in cattle fattening periods on the project's rates of return as well as the high attrition rate in participation by project beneficiaries in waste management practices in the project's final year of operation.

8. Assessment of Bank Performance

a. Quality-at-Entry
The PAD was prepared in about six months from the date of the project preparation mission. Nevertheless, it was to a large extent a comprehensive and well prepared document. The project's design was based on considerable background analysis of the experience of similar projects in China and other countries in the South East Asia Region. The project objective was in line with both Government and Bank strategies. Its design was praised as "high quality" by the Government which underlined that the design was consistent with national policies for the livestock sector and the environment (ICR, Annex 7, page 45). However, this Review has questioned the relevance of design on a number of grounds. The ICR was also critical of the first two PDO indicators in the results framework because they were "difficult to measure during project implementation" (paragraph 5.1.1). The PAD should have been more circumspect in predicting the project's vulnerabilities in the risk matrix since many of the risks noted in the ICR and by this Review were not considered. This was undoubtedly a challenging and path breaking project, but its design had a number of shortcomings such as loading most of the project's implementation responsibilities on the project area counties which were ill prepared for the task. This situation might have been avoided if appraisal had been less rushed. This Review therefore rates the quality at entry as moderately satisfactory.

b. Quality of supervision
The Bank conducted supervision missions at roughly six month intervals with an array of relevant subject matter specialists. The Government expressed satisfaction with the Bank's support during implementation stating that "Being professional, dedicated, responsible and practical, the World Bank project management and (the) expert group guided and supervised the whole development of the project consisting of various work such as preparation, implementation and account closing, which brought about good effect" (ICR, Annex 7, page 48). Clearly there were implementation challenges such how to achieve improved implementation capacity, quality control for construction of livestock waste management facilities, designing actions for training, formulating applied research, MIS development, and project management (see ICR, paragraph 5.1.3), but ultimately they were successfully overcome. Overall this Review rates the Bank's supervision performance as satisfactory.

9. Assessment of Borrower Performance

a. Government Performance
For this project the "Borrower" was the Government of the Republic of China. However, the Provincial Government of Henan undertook the
role as the Bank’s counterpart in the Government during the design and appraisal of the project. The provincial government in turn delegated full responsibility for project implementation to county governments. The ICR noted that the provincial government’s strong support for the project was demonstrated by its commitment to fully support the public-goods oriented ecological aspects of the project and, with the municipal governments, to take on 70 percent of the obligation to the Bank for loan repayment and financing charges. It also provided policy guidance, organized counterpart funds, and enlisted support of other relevant agencies (paragraph 5.2.1). The remaining 30 percent of the Bank loan cost was repaid by the county governments. The Henan government’s strong and continued support for the project farms/parks was also critical to ensure an appropriate transition arrangement to post-completion operations (ICR. paragraph 2.5.3). This Review concluded that the Government’s performance was satisfactory

Government Performance Rating
Satisfactory

b. Implementing Agency Performance
The ICR noted that the implementing agency (Provincial Project Monitoring Office - PPMO) faced a number of daunting challenges, namely (a) the large number of counties (31 out of 86) covered by the project in Henan; (b) lack of staff with experience in managing a Bank financed project; (c) difficulties in convincing livestock farms/parks to participate without a successful demonstration model; (d) difficulties in providing adequate and timely counterpart funding by some counties; and (e) difficulties in identifying experienced procurement agents. These problems led to the lag in disbursements which was reflected in a lag in the County Project Management Offices (CPMO’s) implementation performance during most of the project’s history. In addition, timely submission of progress reports was a chronic problem and the end-project M&E report was delayed and not submitted to the Bank until early June 2016.

It was acknowledged in the ICR that, with Bank support, CPMOs made significant efforts during the last 12-month period of project implementation to expedite project implementation and the disbursement of Bank loan proceeds. Eventually the project was successfully completed by the original closing date with 98.2 percent final disbursement of the total Bank loan proceeds. In light of this result the Implementing Agency’s performance is rated Satisfactory.

Implementing Agency Performance Rating
Satisfactory

Overall Borrower Performance Rating
Satisfactory

10. M&E Design, Implementation, & Utilization

a. M&E Design
According to the PAD the Provincial Project Monitoring Office (PPMO) was responsible for M&E under the overall supervision of the Project Expert Technical Group (PTEG). The PPMO in turn contracted a third party to work with the Management Information System (MIS) established in the earlier Henan Animal Husbandry Bureau (AHB) and for other internationally financed projects (paragraph 34). The ICR noted that the third party private sector entity “conducted semi-annual comprehensive monitoring and inspection of the physical progress of project implementation; construction quality; use of Bank loan proceeds; identification of issues and following up on the findings and recommendations of Bank supervision missions. An Implementation Inspection report was prepared and submitted to the PPMO and the Bank after each inspection with six such reports in total (including a last report submitted in June 2016” (paragraph 2.3.4). The ICR also explained that the “M&E framework featured: (a) simple procedures; (b) a small number of carefully-selected variables that are easy to measure or readily derived from simple measurements; and (c) a coverage of both project progress monitoring and project environmental monitoring” (paragraph 2.3.1).

b. M&E Implementation
As noted above, monitoring and evaluation was carried out by an experienced independent institute to provide credible monitoring services. A total of 10 surveys were carried out to monitor the achievements. Environmental monitoring was carried out through surveys following the requirements of an Environmental Management and Monitoring Plan (ICR, paragraph 2.3.4). The management of M&E activities was the responsibility of the various Animal Husbandry Bureaux in the counties through (a) the MIS; (b) surveys; and (c) samplings. The MIS was
developed and used by all levels of the PPMO and CPMOs and was, according to the ICR, an efficient tool for reporting requirements such as physical progress monitoring, contract-based procurement management, and financial management (paragraph 2.3.2). However, as reported in the ICR (paragraph 2.3.3), although the MIS was in place mid-term impact evaluation surveys were not carried out, a Mid-Term Review report was not prepared, project progress reporting by counties was frequently not up-to-date, and information provided in both Chinese and English versions of progress reports contained discrepancies. The ICR noted that at "the end-project M&E report which provided data and information for assessing the achievement of outcome indicators was submitted to the Bank only in early June 2016 when the Bank team made a final round of urgent request (the Bank team made repeated requests for evidence prior to the final round). Lack of timely submission of reports continued to persist" (paragraph 5.2.3). Nevertheless, eventually M&E data were delivered and two end of project reports ("Social Impact Assessment Completion Report" and an "Environmental Impact Assessment Completion Report") were also prepared by an experienced and independent Chinese institution (paragraph 2.3.5).

c. M&E Utilization
The PPMO used the MIS for real-time information on the progress of investments in the project counties identifying project farms/parks that missed key milestones and/or lagged behind the implementation schedule. In collaboration with the counties and, despite the shortcomings in the MIS data base, the PPMO was able to facilitate timely interventions to correct problems and accelerate project implementation (ICR, paragraph 2.3.2).

M&E Quality Rating
Substantial

11. Other Issues

a. Safeguards

Environment Safeguards. The project was classified as an Environmental Category B project and triggered safeguard policy on Environmental Assessment (OP/BP 4.01). An Environmental Impact Assessment (EIA) report was prepared following China’s national environmental guidelines and the Bank’s safeguard policies. A detailed (EMMP) was developed which clearly specified responsibilities of the PMOs and other relevant institutions, environmental management training and capacity-building needs of the project and environmental monitoring plan and their respective costs. An environmental screening checklist was developed and used for the selection of candidate farms/parks, and all candidate farms/parks prepared an EIA following domestic approval procedures (ICR, paragraph 2.4.1). The ICR noted that an independent institution was selected to monitor the EMMP implementation. Monitoring results confirmed that project environmental assessment procedures were closely followed and the project complied fully with the EMMP (paragraph 2.4.1).

Social safeguards – The PAD shows that that the Bank’s safeguard policy on Involuntary Resettlement (OP/BP 4.12) was triggered (paragraphs 42 and 67). Although land acquisition was not anticipated, construction activities other than on farms/parks might take place. To guide any event during project implementation in which involuntary taking of land would occur, a Policy Framework for Resettlement and Land Acquisition (RPF) was prepared, disclosed and included in the Project Implementation Manual (ICR, paragraph 2.4.1). According to the ICR the RPF was closely followed throughout project implementation and neither land acquisition nor resettlement was found necessary since all construction on project farms/parks took place on existing leases. The Social Impact Assessment Completion report prepared by an independent institution confirmed the project’s significant positive social impacts in the aspects of land use, infrastructure construction, cooperative mechanism, income and benefit sharing, women and vulnerable, training, environmental improvement, participation and grievance redress. The report concluded that project’s implementation was in compliance with the Bank’s social safeguard policies.

b. Fiduciary Compliance

Procurement. The ICR reported that the Bank’s procurement policies and procedures were satisfactorily followed under the supervision of the PPMO and the active support of procurement agents. It went on to state that the procurement and implementation capacities of the PPMO and the CPMOs were effectively improved. No substantial procurement issues were identified. Some general and minor issues caused mainly by lack of experience of county PMOs and the procurement agents (especially in earlier years of project implementation) were addressed and
resolved through Bank supervision missions and timely communications (ICR, paragraph 2.4).

**Financial Management (FM).** According to the ICR a sound internal financial control system was put in place to ensure that project funds were used for intended purposes. The project’s FM was in compliance with the Loan Agreement. The FM related documents were well maintained by relevant municipal or county PMOs. Payments to contractors were made on a timely basis. The project’s Bank loan disbursement was lagging behind the PAD schedule throughout project implementation with a final disbursement of US$78.57 million or 98.2 percent of the total Bank loan amount. All audit reports were timely and unqualified (ICR, paragraph 2.4.2).

c. Unintended impacts (Positive or Negative)

**Poverty Reduction:** Though the project was not focused on poverty reduction, the ICR states that it paid special attention to the engagement of the poor, women and ethnic minorities for the purposes of alleviating poverty, promoting social inclusion and gender equality. Of the total employees on project farms/parks, 190 or about 4 percent were poor. According to the ICR their income was increased through employment on farms in the project. Poor employees earned the same amount as the other employees in the project farms/parks averaging annual incomes between RMB22,000 to RMB24,000. The 190 poor employees were successfully lifted out of poverty status (ICR, paragraph 3.5.2). On the other hand the direct beneficiaries of the project (farms and parks) totaled 468 “small scale and medium sized livestock farms/parks” or enterprises (ICR, paragraph 1.4.1) which according to Annex 10, Section 5.1 were made of 194 farmer cooperatives (41.45%), 173 sole proprietorship companies (36.97%) and 101 joint stock companies (21.58%). The Social Impact Assessment Completion Report (page 76) states that 1,434 households participated in the project on the 468 farms under the three types of management of which 919 were on milk cow enterprises, 439 on beef cow enterprises and 76 on pig production enterprises. Assuming that the 173 sole proprietorship companies did not involve any households, the average number of households on the two other enterprises would have been 15 households (1,434/295=15.09). Considering that the model dairy enterprises had 500 milking cows (ICR, Annex 3, Table 8) the average herd size for the 15 households would have been 33 (500/15=33.3). This was quite a large operation for one household and very unlikely to be a household whose income was at or below the poverty line. The ICR does not comment on this issue or indicate whether this lack of focus on arguably non-poor households was an unintended consequence of the project’s design. However, in an exchange of views on this issue with IEG the project team stated that the project was not intended to address either poverty reduction nor improvements in prosperity of the poor.

**Gender Aspects.** According to the ICR project training programs strengthened women’s knowledge and awareness of environmental protection and improved their technical skills for ecological livestock production which facilitated the rise of their income and social status. Women and men had the same opportunities in project participation and women’s participation in the project was significant. About 34 percent of the trainees were women; over 28 percent of the total number of owners of project farms/parks were women; and over 22 percent of the total project employees were women.

**Social Development.** The ICR noted some social development aspects associated with the project. For example;

- The project farms/parks brought social benefits to local (non-project) farmers and contributed to improvements in rural economic and social development in project areas because local farmers benefitted significantly from; (i) lease of land to project farms/parks; (ii) provision of feed and fodder to project farms/parks; (iii) employment in project farms/parks; and (iv) regular training (ICR, paragraph 3.5.4). According to the Social Impact Assessment Completion Report, 96 percent of the surveyed households were satisfied with the improvement of the farm-related environment, and 77 percent of the surveyed households confirmed major contributions of the project farms/parks to their increased income (ICR, paragraph 3.5.4).

d. Other

**Institutional Change/Strengthening**
According to the ICR the project established closer institutional cooperation among government line agencies, universities and consulting institutions which functioned well together. Capacity of public institutions and the skills of PMO staff were significantly improved through training and access to essential equipment and facilities.

**Imaginative Responses**
The project enhanced environmental awareness of environmental issues on livestock farms in Henan. For example a number of project farms/parks (i) increased the size of waste water ponds for off season storage of waste when the demand for fertilizer is low; (ii) generated biogas from livestock waste; and (iii) used livestock waste to produce other products such as mushrooms, lotus roots and earth worms.
12. Ratings

<table>
<thead>
<tr>
<th>Ratings</th>
<th>ICR</th>
<th>IEG</th>
<th>Reason for Disagreements/Comment</th>
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<tbody>
<tr>
<td>Outcome</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>---</td>
</tr>
<tr>
<td>Risk to Development</td>
<td>Modest</td>
<td>Substantial</td>
<td>The difference in rating is due to the vulnerability of the project's rate of return to small changes in milk yield and cattle fattening periods as explained in Section 7</td>
</tr>
<tr>
<td>Bank Performance</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>The difference in ratings is due to this Review's rating of the project's quality at entry as moderately satisfactory which brings the overall rating down.</td>
</tr>
<tr>
<td>Borrower Performance</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>---</td>
</tr>
<tr>
<td>Quality of ICR</td>
<td>Substantial</td>
<td>Substantial</td>
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Note
When insufficient information is provided by the Bank for IEG to arrive at a clear rating, IEG will downgrade the relevant ratings as warranted beginning July 1, 2006.
The "Reason for Disagreement/Comments" column could cross-reference other sections of the ICR Review, as appropriate.

13. Lessons

The ICR suggested three lessons from the project which are summarized briefly below highlighting their broader relevance to development programs.

(a) **Actions to Address Environmental Hazards Require Supportive Policies and Regulations.** A range of national and provincial policies and regulatory frameworks relevant to livestock waste management can provide the legal basis and opportunities for financial incentives in a successful project to support improved management of livestock waste.

(b) **Government Commitment to the Project's Objective is Essential to Successful Outcomes.** Stakeholders' commitment, dedication and capabilities are critical to ensure project success, sustainability and ownership. These were demonstrated through exceptional commitment and strong leadership by the government at provincial, municipal and county levels in making key decisions and providing policy guidance.

(c) **Public Goods Generated by Environmental Investments Need to be Valued Accurately to Reward Private Investors Equitably.** To achieve public good benefits from an investment project a financial subsidy to participating private investors is essential. The final cost sharing contribution from the private investment provides an estimate of the participating private investor's direct benefit and hence the amount that investor are willing to pay as a share of the total cost.

IEG would add the following two lessons from this project.

(a) **Sustaining a Government Subsidized Program of Livestock Waste Management may be Excessively Costly.** The results of this project show that even a 50 percent average government subsidy to participating enterprises to cover the capital costs of livestock waste management practices may not be enough to sustain the waste management operations. This raises questions about the capacity of governments to pay adequate subsidies to ensure the sustainability of projects such as this one implemented in some Henan counties.

(b) **Need to Sustain Environmentally Appropriate Waste Management.** If projects such as this one are pursued then recipients of subsidies aimed at encouraging livestock enterprises to invest in environmentally appropriate livestock waste management practices need to agree to sustain those management practices in the longer term for periods such as the expected life of the investment.

14. Assessment Recommended?

Yes
Please explain

An assessment is recommended so as to (a) assess the sustainability of the waste management systems in light of the high attrition rate of farms no longer operating waste management in this project even before the project's closing date; and (b) determine why a substantial proportion of farms no longer operated waste management techniques despite having receive a considerable subsidy for the waste management investments.

15. Comments on Quality of ICR

The ICR was reasonably comprehensive, well written, provided the context for the project, and generally followed the guidelines for the preparation of ICRs. However, it was not as candid as it could have been because a crucial negative issue, namely the high attrition rate of enterprises that had received subsidies from the project which was documented in the Social Assessment Completion Report, was not mentioned in the ICR. The lessons could have been more clearly stated such that they might be used more generally and not just for this project.

a. Quality of ICR Rating
   Substantial