

---

# Contents

*Preface*      vii

*1 Introduction and Policy Overview*      1

    Methodology      2

    Conclusions and Policy Implications      9

**Part One      The Decision to Plow**

*2 Farming Intensity and the Plow: The Analytical Framework*      25

    The Evolution of Farming Systems in the Tropics      26

    Farming Intensity, Cultivation Techniques, and Labor Use      28

    From the Digging Stick to the Plow      33

    Areas in Which Destumping Is Not a Major Constraint      36

    Trypanosomiasis as a Constraint to Agricultural Intensification      39

*3 The Driving Force of Intensification*      43

    Evidence of Agricultural Intensification      51

    Agricultural Intensification and Changes in Sources of Power      55

*4 Other Factors That Affect the Profitability of Mechanical Inputs*      57

    Determinants of the Yield Response to Tillage      57

    The Effect of Season Length on Potential Utilization of

        Capacity      65

    Utilization of Capacity through Rental Markets      68

    High-Potential Tropical Highland Areas That Have Bypassed  
    the Plow      69

5 *Animal Draft and Tractor Power in Sub-Saharan Africa:  
A Historical Overview* 71

Pockets into Which Animal Traction Spread Spontaneously  
before 1945 73

The Development of Animal Traction after 1945 77

The Introduction of Tractors into Sub-Saharan Africa 80

Part Two Animal Draft

6 *False Assumptions Concerning Animal Draft* 89

Animal Traction as a Regressive Technology 89

Lack of Mechanical Skills and Repair Services 90

Lack of Animals and Skills in Animal Husbandry 92

Cultural Differences 94

Significance of Oxen Size 95

Lack of Fodder 95

7 *Farm-Level Benefits of the Transition to the Animal-Drawn  
Plow* 98

Area Effects 99

Yield Effects 102

Effects on the Use and Productivity of Labor 105

Effects on Livestock Raising 108

The Income Effect 110

The Concentration of Income and Wealth 112

Appendix: A Framework for Evaluating the Benefits of  
Animal Traction 116

8 *Conceptual Issues in the Design of Animal-Traction  
Projects* 119

The Farming System and the New Technology 119

Essential Components of an Animal-Traction Project 126

Domestic and Regional Production of Equipment 131

Part Three Motorized Agriculture

9 *The Selective Pattern of Agricultural  
Mechanization* 137

Power Intensity versus Control Intensity 137

The Mechanization of Stationary Operations 139

The Mechanization of Mobile Operations 144

Factor Endowments and Agricultural Mechanization 147

Two Approaches to the Choice of Mechanization 151

<i>10 Prospects for Tractorization in Sub-Saharan Africa</i>	153
Replacing Animal Draft with Tractors: The Choice of Techniques	154
Effects of the Transition from Animal Draft to the Tractor Tractorization at the Late Bush-Fallow and Early Grass-Fallow Stages	166
Direct Transition to the Tractor in a Treeless Environment	169
<i>11 Mechanization Choices for the Humid Tropics</i>	173
Technological Choices with Tree Crops	174
Technological Choices without Tree Crops	175
Systems without Trees	177
<i>12 Public Tractor-Hire and Equipment-Hire Services</i>	179
Background and Historical Perspective	179
Operations for Which a Tractor-Hire Service Is Provided	182
Overriding Problems of the Tractor-Hire Service	182
Can Private Tractor-Hire Services Do Better?	187
Conditions Necessary for Successful Contract-Hire Operations	190
<i>References</i>	191
<i>Index</i>	207