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The employment dimension of infrastructure investments

A guide for employment impact assessment

Christoph Ernst, Steve Miller
and Marc Van Imschoot

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and Investment
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Preface

The primary goal of the ILO is to work with member States towards achieving full and productive employment and decent work for all. This goal is elaborated in the ILO Declaration 2008 on Social Justice for a Fair Globalization, which has been widely adopted by the international community. Comprehensive and integrated perspectives to achieve this goal are embedded in the Employment Policy Convention of 1964 (No. 122), the Global Employment Agenda (2003) and – in response to the 2008 global economic crisis – the Global Jobs Pact (2009) and the conclusions of the Recurrent Discussion Reports on Employment (2010 and 2014).

The Employment Policy Department (EMPLOYMENT) is engaged in global advocacy and in supporting member States in placing more and better jobs at the center of economic and social policies and growth and development strategies. Policy research and knowledge generation and dissemination are essential components of the Employment Policy Department's activities. The resulting publications include books, country policy reviews, policy and research briefs, and working papers.

The Employment Policy Working Paper series is designed to disseminate the main findings of research on a broad range of topics undertaken by the branches of the Department. The working papers are intended to encourage the exchange of ideas and to stimulate debate. The views expressed within them are the responsibility of the authors and do not necessarily represent those of the ILO.

Azita Berar Awad
Director
Employment Policy Department

Foreword

This guide is about remembering to count. Government leaders, politicians, social activists, trade unions and business leaders all understand the importance of job creation. Jobs, or the lack of them, can make or break governments, can lay the foundation for peace or unrest, determine whether globalization is fair or unjust. Political leaders often promise job creation in political speeches, industry executives promise that foreign direct investment will create new jobs, the international development community assures policy makers in developing countries that skills development, self-employment and public works projects will bring jobs. While all agree to the importance of job creation, few remember to count how many jobs will be - or actually were – created as a result of proposed policies.

In the context of this guide, remembering to count means assessing the employment impact - in other words counting how many jobs will be or were saved or created - of public or private investment projects or programmes. This review provides an overview of different methodologies and approaches currently being used to count or to estimate job creation in the framework of investments. Some approaches can be characterized as "quick and dirty" "back-of-the-envelope" calculations; others involve complex simulations, modelling and data requirements. In either case, and in the case of all the methodologies in between, running from the straightforward to the complex, the vision is simple: remember to count!

The International Labour Organization's efforts to spearhead the use of employment impact assessments brings to mind the long and still on-going work, begun in the 1960s, of environmental activists and policy makers to advocate, and then develop methodologies, for environmental impact assessments, which are now in many cases required by law. Employment impact assessments can be a reality check on those who make flippant promises as to the job creating potential of this or that "pet" policy. They can also be a mechanism for real job creation by providing politicians, policy makers, business leaders, social partners and civil society with the evidence required to engage dialogue in favour of job creation.

The initiative to develop and implement employment impact assessments grows out of one of the International Labour Office's longest standing and most successful technical cooperation programmes: the Employment Intensive Investment Programme (EIIP). Following the World Employment Conference of 1976, the ILO launched a series of employment programmes known as Special Public Works Programmes to provide jobs and meet basic needs of poor rural populations. At the same time, it developed a programme of action research in the area of jobs and technology, analysing and testing approaches for maximizing employment in infrastructure projects through high-quality and cost effective labour-based methods. In the 1980s, these two programmes joined forces to become what is now known as the EIIP. In the 1980s, the programme was active in 32 developing countries and had an annual delivery of 23 million US dollars. (ILO, 1990).

Once it had been demonstrated that certain kinds of infrastructure could be delivered cost effectively by labour-intensive methods, there was a growing preoccupation to taking these successful but relatively stand-alone projects to scale. What if, based on the experience of successful pilot projects, efforts were made to ratchet up the employment content of infrastructure investments throughout a category of infrastructure or a certain sector of the economy? What would be the overall impacts on job creation and would these impacts be sustainable? Rather than focusing on implementing infrastructure projects with a standard package of labour-intensive technologies, the focus began to shift towards identifying opportunities for increasing the employment content of investments and then quantifying – that is counting – the amount of employment being created.

Employment impact assessments then grew out efforts to take the ILO's EIIP to scale, and this review is intended to facilitate and strengthen wider scale adoption of EmpIA within and outside the standard programme, extending it as well to emerging and developed countries. Today, EIIP is still active in more than 40 countries supporting employment-intensive programmes as well as employment assessment studies. This Guide will respond to growing interest and need beyond the immediate circle of ILO constituents – this interest and need being grounded in the fundamental challenge of how to create jobs.

Terje Tessem
Chief of Development and Investment
Branch

Acknowledgement

The preparation of this review has been a collaborative effort of colleagues in the ILO's Employment Intensive Investment Programme. The lead author is Christoph Ernst, with Marc Van Imschoot collaborating author. Special thanks go to Emilio Salomón who prepared the section on the Priority Setting Matrix, to Samuel Yemene for the section on input-output analysis, Senija Steta for her inputs into Annex 3 on "Economic models and tools used to assess long-term economic, social and labour markets impacts," to Marianela Sarabia for her extensive comments and explications, and to Steve Miller for his contributions as well as an extensive review and re-writing of the draft version of this document.

Executive summary

This ILO Working Paper presents a review of relevant tools and methods for assessing the employment dimensions of infrastructure investment. As such, it is a guide for undertaking employment-impact assessments, which are a cornerstone of the ILO's strategy for job creation. By way of introduction, the history and evolution of the ILO's Employment-Intensive Investment Programme (EIIP) is outlined. Employment-impact assessments provide a key methodology for taking this programme to scale, moving from a series of discrete projects and programmes to a broader strategy which aims to assess and increase the impact of infrastructure investments not only on productivity growth, but also on the quantity and quality of employment.

Since the EIIP is an operational and global programme based on ILO support to national governments in implementing and evaluating labour-intensive infrastructure investments, this guide is not an academic exercise but is rather inspired by the ILO's practical experience providing technical cooperation and analysis to countries throughout the world. Project monitoring and evaluation are key to successful implementation, as are the requirement of management information systems (MIS) recording physical and financial progress as well as employment indicators.

Part two of this review presents different economic models used to evaluate the impact of projects, specifically, and of infrastructure investment policies and programmes, more generally, on growth and employment, as well as on a number of other economic indicators. The focus on this guide is on models based on input-output tables which are used to estimate short-term job creation. Other approaches more suitable for long-term employment impacts are presented in annex.

The focus then is on input-output models, social accounting matrices and on dynamic social accounting matrices. Input-output models look at direct and indirect output effect of policy interventions/investments, also on employment in combination with an employment module whereas social accounting matrices have the ability to build on these to look additionally at the induced effect of higher income through labour and at the distributional impacts of public investments. Through the creation of employment satellite accounts, I-O and SAM models, combined with an employment module or satellite account, are able to see how employment impacts affect different groups within the workforce. Such a level of analysis is important in assessing which group of workers benefits most from a specific public intervention thus contributing to a better targeting of public investments. Finally dynamic social accounting matrices introduce an additional level of analysis which permits one to assess how these economic and employment impacts evolve over time. While all input-output models are fixed price models, a dynamic SAM introduces some elements of how prices, productivity, behavioural changes, incentive structures and other elements affecting employment impact change over time.

Employment impacts are measured in terms of not only direct jobs creation, but also indirect jobs created throughout the production chain and in terms of induced jobs created through the impact of workers' salaries on the broader economy.

The guide also provides practical guidance on the data, inputs and human resources required to carry out employment impact assessments as well as an overview of the strengths, weaknesses and challenges which different methodologies present, particular in the context of developing countries with limited data and statistics, and financial and human resources. Although the primary focus is on developing and newly industrialized countries, the review also touches on recent work carried out in advanced industrialized countries and stresses the rising interest in understanding the employment effects of public interventions in all parts of the world, irrespective of level of development. The review concludes with some directions for future work in this field.

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Abbreviations

A	Activities
ADB	Asian Development Bank
ALP	Average Labour Productivity
APS	Average Propensity to Spend
BPS	Indonesian National Bureau of Statistics
C	Closed loop
CBA	Cost-Benefit Analysis
CGE	Computable General Equilibrium
Co	Commodities
DTU	Decentralization Technical Unit of the Ministry of Finance
DW	Decent Work
DWCP	Decent Work Country Programme
DySAM	Dynamic Social Accounting Matrix
EAE	Equivalent Annual Employment
EFSI	European Fund for Strategic Investments (“Juncker Plan”)
EIIP	Employment-Intensive Investment Programme
EmpIA	Employment Impact Assessment
EMSPI	Employment Monitoring System in Public Investment
EGS	Employment Guarantee Schemes
ERR	Economic Rate of Return
EPWP	(South Africa’s) Expanded Public Works Programme
EPZ	Export Processing Zone
Fp	Factors of production
FoF	Flows of funds
FDI	Foreign Direct Investment
FSP	Fiscal Stimulus Package
FSPC	Fiscal Stimulus Package Construction

FTE	Full-time equivalent
GDP	Gross Domestic Product
GVO	Gross Value of Output
HS	Household Survey
IDR	Indonesian Rupiah
iE	Institutions
IFI	International Financial Institution
IFPRI	International Food Policy Research Institute
I-O	Input-Output
ILO	International Labour Office
IPR	Inward processing regime
IRR	Internal Rate of Return
LFS	Labour Force Survey
M1	Multiplier of intra-account effect
M&E	Monitoring and Evaluation
MF	Ministry of Finance
MIS	Management Information Systems
MPWT	Ministry of Public Works and Transport (Cambodia)
MRD	Ministry of Rural Development (Cambodia)
MU	Measurement Units
NCAER	National Council of Applied Economic Research (India)
NPIS	(Paraguay's) National Public Investment System
NPV	Net Present Value
O	Open loop
PEP	Public Employment Programmes
PIP	Public Investment Programmes
PIS	Public Investment System
PREALC/ILO	ILO Regional Employment Programme for Latin America and the Caribbean

PRS	Poverty Reduction Strategy
PRSP	Poverty Reduction Strategy Paper
PWP	Public Works Programmes
RIIP	Rural Infrastructure Improvement Project (Cambodia)
SAM	Social Accounting Matrix
SNA	System of National Accounts
SPPRSD	Azerbaijan’s State Program on Poverty Reduction and Sustainable Development
SUT	Supply-Use Table
SVAR	Structural Auto-regression
VAR	Vector Auto-regression
W/M	Work Month

Part I: Purpose and Scope of Employment Impact Assessments

1 Introduction

1.1 Background

Over the past four decades, the ILO's Employment Intensive Investment Programme[1] has evolved considerably from a series of relatively stand-alone labour intensive programs – with positive but limited impacts of employment and living conditions in target populations – to more systemic interventions which, based on the earlier pilot experiences, contribute to both job creation and reduction of infrastructure deficits on a larger and more systematic scale. The ILO's Employment-Intensive Investment Programme has involved a wide variety of infrastructural improvements from a different technical sectors (these were initially rural projects such as water supply, reforestation, erosion control, small dam construction, irrigation, watershed management, feeder road construction, rehabilitation and maintenance, construction of buildings such as schools, health centres, cereal banks, and later the program branched out to involve urban works such as slum upgrading, street paving, sanitation and drainage). Maintaining as a common feature the dual objectives of asset and employment creation, employment-intensive investment programmes feature a varying mix of these and other objectives and can be categorized as follows:

Sectoral infrastructure investment programmes where priority is given to implementing good quality assets and where the objective of job creation is important, but secondary, in that employment is optimized without compromising the quality of infrastructure. Such programmes are often implemented by technical ministries such as the Ministries of Roads, Water Development, Rural Development, Urban Development, Forestry, Irrigation, etc. Generally the works are contracted out to SMEs or to CBOs for implementation using labour-intensive approaches.

Local area-based development programmes which have infrastructure components, support decentralization and are implemented and funded by local government authorities (municipalities, districts, Ministries of Regional or Local Development, etc.). These tend to be multi-sectoral programmes where, in addition to job creation, there is a broader objective of local economic development and optimizing the use of local resources.

Finally, **public employment programmes (PEP),** such as public works programmes (PWP) and employment guarantee schemes (EGS), can help protect the most vulnerable groups, while at the same time developing infrastructure, assets and services that promote social and economic development. Such programmes can be designed either in response to a crisis, as part of longer term, counter-cyclical employment policy or to reduce inequalities. Primary objectives focus on both employment generation and income support.

As the EIIP evolved, with a growing number of projects completed and the evidence base increasing, the ILO in its both analytical and operational work has focused on both the quantitative and qualitative dimensions of decent work. Such research includes feasibility and baselines studies, project evaluations and impact assessments. Furthermore a multitude of studies and project evaluations were undertaken to assess the actual or potential impact

[1] For a good overview of this program, which, as mentioned above, grew of the Special Public Works Programmes implemented in the 1970s and 1980s, see ILO (1998).

of public investment budgets, programmes and projects on employment creation. These employment impact assessments can have varying scope and objectives, and can be grouped into a number of broad categories:

- The first category examines micro-level project data to compare technology choice: labour-based and equipment-based methods for infrastructure construction.
- A second category of studies analyses the employment impact of infrastructure components of certain sectors of a given government's public investment programme or for a public investment budget as a whole.
- A third category of studies builds on the methodologies and results of the previous two categories. The methodologies employed (e.g., input-output models, social accounting matrices) have the objective of evaluating actual or potential impact of infrastructure development programmes (at times comparing labour-based with equipment-based options) on a variety of macro-economic variables such as employment creation, GDP, household income and consumption, private investment, public finance deficit, investment spending, fiscal earnings, balance of payments and multiplier effects.
- A fourth category of "socio-economic impact" studies analyse the longer term potential impact of a better infrastructure available to the beneficiary populations, including economic effects (market access, trade, investment, productivity, supply and price effects), but also social effects (connectivity, access to health and education services, food and energy security) and labour market effects. These studies (e.g. cost-benefit analysis, economic and econometric analysis) are normally carried out by financing investment banks, including regional and global development banks.[2]

Research can assess, *ex-post*, employment impacts of actual investment programmes[3], or it can simulate, *ex-ante*, the employment-impacts of proposed investment programmes in order to help policy makers better assess the costs and benefits, particularly in terms of job creation, of alternative investment scenarios.

Work on development and application of employment-impact assessment methodologies has accelerated during the past decade and become a priority area of work following decisions by the ILO Governing Body in 2005 when it asked the Office to develop "methodologies and approaches, such as impact assessments for integrated environmental and employment outcomes of investment plans and programmes" (ILO, 2005 para. 34, p. 12) and subsequently in November 2006 endorsed as a strategic priority the ILO's work on EIIP: "promoting systematic employment impact assessment of public and private investment programmes and policies to enhance EIIP's selectivity and support to the development of strategic project streams" (ILO, 2006a, p. 10, para. 43(i) and ILO, 2006b, para. 207, p. 40).

The immediate concern of this Guide is to develop suitable tools for undertaking employment impact assessments to help ILO field personnel to provide sound and practical policy advice on avenues for job creation through infrastructure development.[4] However, interest in undertaking EmpIA also includes academics, policy makers and practitioners beyond the ILO.

A starting point for all EmpIA methodologies is the acceptance of "employment" as an indicator and ensuring that the required data is available at national, sector and regional

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[2] See Annex 3 for an overview of models and tools used for assessing longer-term economic, social and labour market impacts.
[3] Such as, for example, the infrastructure component of the American Recovery and Reinvestment Act in the United States which began in 1998 and is largely completed.
[4] This section draws on the conclusions of a Workshop on Employment Impact Assessments which was held at the International Labour Office in Geneva, 18 – 19 March 2008.

levels. Moreover, models should look at direct and indirect employment effects and as well as consider induced employment generated by investment, in particular from infrastructure asset creation, as well as through increased consumption and tax collection.

Different methodologies are required for different levels of programming and implementation. Various kinds of macro-level studies (economic, social, legal analysis) can be used to assess the impact of employment intensive approaches. A social accounting matrix (SAM) may be an appropriate model for national or regional levels, or input-output tables could be helpful in countries where SAMs do not exist or where a simpler and more rapid methodology is required. Input-output tables are also the starting point for constructing a SAM. General equilibrium models (CGEs) could be superimposed on a SAM at central, sector or regional level, depending on requirements.

It is important, in deciding on the most relevant methodology, to bear in mind who will be using it and how it will be used.[5] Generally these are not academic studies, but rather a guide to policy makers on how to prioritize and decide between different alternative public investment options. Simpler methods are often sufficient to prioritize investments. Macro-level studies can be used strategically to guide the work of decision makers and funding agencies. Such studies can help transition from policies reflected in framework documents, such as Decent Work Country Programmes or Poverty Reduction Strategies, to practice, i.e., implementing labour-intensive (employment generation) approaches for infrastructure development.

The financial crisis which swept the globe beginning in 2007, and the resultant stimulus packages that were put in place in many countries, put popular pressure on governments to justify that their employment objectives were being met. EmpIA methodologies can be designed to meet these needs. They can also be useful in understanding structural unemployment for many countries (Ghose et al., 2008) and provide guidance on what measures will work to overcome a cyclical or a structural crisis.

1.2 Institutionalizing employment into public investment programmes

Before embarking on employment impact assessments, it is useful to consider who will use and "own" these assessments, in other words, how will employment as a criterion for programme development, implementation and evaluation be "institutionalized"? For one, technical line ministries, which are the main users of public investment resources, may wish to integrate an employment criterion into their planning, programming and budgeting work. It furthermore involves the work of political, planning and coordinating ministries (e.g., Ministries of Economy or Economic Planning, Finance, Budget, Decentralisation, etc.) who are responsible for the allocation or coordination of public investment resources across sectors.

The main tasks of the former (i.e., technical line ministries) would be:

- To assess from the design stage, technological options and adopt the most employment-generating approaches whenever this is technically feasible and economically cost-effective;
- To define technical and engineering standards in different fields of activity;
- To reflect employment considerations in contract documentation;

[5] For more on the use and users of EmpIA methodologies, see section on: Institutionalizing employment into public investment programmes, below.

- To set up appropriate monitoring mechanisms to optimise the use of locally available labour and resources in construction and maintenance;
- To work with the national cross-sectoral institutions to integrate sector specific goals (e.g., roads, irrigation, environmental protection, etc.) into overall development goals and commitments (e.g., PRS, DWCP, national development plans, etc.)to identify potential constraints to meeting employment targets and develop ways and means for overcoming such constraints, e.g. training and strengthening the network of small and medium size enterprises, consulting engineers, employers' and workers' associations of the construction industry, community based organisations; and providing them with effective access to procurement contracts, including modification of procurement systems, etc.

To get the employment objective institutionalized more strategically and more concretely in public investment programmes, some governments have begun to prepare their national programme and budget using a budget planning process by strategic objectives. Within this framework, ministries of economy, finance or budget collaborate with technical line ministries or with local government in order to better integrate employment indicators into the preparation and evaluation of PIPs. Budgeting by strategic objective can be facilitated by upstream development of a Medium-Term Expenditure Framework, a complementary process set up in many countries which provides decision makers with improved data and analytical studies. Employment Impact Assessments therefore can be an integral element of medium-term expenditure frameworks and of strategic budgeting processes.[6]

1.3 Purpose and coverage of employment impact assessment tools

The core focus of the ILO's work in employment impact analysis has typically been public investment programmes in the infrastructure sector, in particular in subsectors where labour-based construction methods are technically feasible and cost-effective, such as tertiary or rural roads. These may be large national infrastructure programmes, or smaller regional or local programmes. However, other economic sectors, such as the green economy, may also be the target of employment impact analysis, involving the identification of "green jobs."

Public investment is in general allocated over various Ministries and sometimes linked to private investment (private-public partnerships). Different levels of analysis have to be covered simultaneously. At the macro level, the focus will be on fiscal policies, mainly the public budget. The public budget will be subdivided between recurrent public expenditures and public investments. The degree to which public spending feeds back into government revenue through tax collection and consumption of government services will influence the results of an employment impact analysis. Public investment may also stimulate or "crowd in" private investments (domestic or FDI); or conversely, it may "crowd out" or impact negatively on them. Public spending also influences the export and import structure of an economy.

The meso level concerns the sectoral decomposition of public investment: to which sectors is public investment allocated and which other sectors are directly or indirectly linked to the concerned sectors (forward and backward linkages)?

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[6] See Appendix 1 for a practical example of priority setting within a PIP developed in Paraguay. The model allows monitoring of employment at the macro, meso and micro levels of public investments.

Employment impact analysis should also help to understand what the public investment decisions mean for workers and households. Do they create new jobs, and for whom: poor or rich workers, unskilled or skilled, young or old, men or women, rural or urban? How and to what extent do public investments impact on the income of various household types, reduce their vulnerability and help them overcome poverty? Furthermore, do the jobs created actually benefit the unemployed; or rather do they benefit categories of workers who are already employed, leading to higher wages and longer hours rather than additional job creation? EmpIA should be linked to the labour market context (i.e., slack or tight) pertaining to specific categories of workers in which job creation is occurring.

A major challenge of EmpIA is not only to analyse the different levels separately, but also to understand the links and transmission channels between them.

Employment impact analysis can be ex-ante or ex-post. It can be used to evaluate the effectiveness of completed projects, or it can be used as a prognostic tool to simulate the current and future impacts of a public investment programme.

Technology choice forms another important dimension of employment impact analysis which should help policy makers choose amongst different technology mixes (i.e., between capital-intensive and labour-intensive methods, or between the various intermediary options) for the implementation of a public investment programme.

Chapter two will provide an overview of project-level monitoring, evaluation and impact assessment as methodologies in their own right, but also as a means to provide useful data input for more macro impact assessment tools. Chapter three will present an overview of past studies and methodologies used by the ILO to demonstrate the advantages and impacts of employment intensive methods for infrastructure development.

Part II of this Guide will look in more detail at three types of models all of which are based on input-output tables which were first proposed by the Economist Wassily Leontiff in 1936. These models go beyond simple cost comparisons of different technological approaches towards infrastructure investments and are able to operate at the micro-, meso- and macro-economic levels to estimate economic and employment impacts, including direct, indirect and induced employment effects as well as other labour market outcomes. Chapters four, five and six then focus on input-output models, social accounting matrices (SAMs) and dynamic social accounting matrices (DySAMs), respectively. All of these models are presented in terms of their theoretical underpinnings and the steps required to construct and use them to simulate different policy scenarios. Numerous examples and practical applications are provided for each type of model, based on studies and projects with which the ILO has been directly involved.

Chapter seven describes the data requirements for different types of employment impact assessments both at the project level and in terms of economic indicators to be used in simulating impacts on the broader economy. Chapter eight then concludes by comparing strengths, weaknesses and applicability of the different methodologies.

2 An overview of project monitoring, evaluation and impact assessment

2.1 Objectives of project monitoring, evaluation and impact assessment

Monitoring, evaluation and impact assessment are used to answer a few simple questions:

1. Has a project (or programme) delivered what it was expected to deliver? On time and on budget?
2. How well was it done?
3. What impacts has it had?

Monitoring, evaluation and impact assessment systems can be applied to public investment programmes which may take several forms, including those mentioned above, namely, sectoral investment programmes, local development programmes and public employment programmes. Such systems need to operate – and collect reliable quantitative data - at several levels:

- To measure the scale, nature and impacts of the employment created through the programme;
- To measure the scale, nature and impacts of the assets and services created;
- To measure the scale, nature and impacts of the injection in the local economy, in particular the employment created.

This chapter provides an overview of project monitoring, evaluation and impact evaluation systems in order to set the stage for the main subject of this review, namely employment impact evaluation methodologies. More qualitative assessments will require other methodologies and competencies.

2.3 Differentiating between project monitoring, evaluation and impact assessment

Monitoring and evaluation (M&E) systems are focused at the programme or implementation level and follow a logical framework based on a hierarchy of development and immediate objectives, outcomes, outputs, activities and inputs (see Figure 1 below). M&E systems monitor – in order to later evaluate – whether the project's inputs (such as labour, training, equipment, materials, human resources, capacity building) led to the planned outputs; whether funds allocated were spent and used for the purpose intended; whether projected budgets accurately covered the costs entailed; and whether the programme reached its targets, including target beneficiaries and geographical areas to be covered.

Monitoring is the first part of this process. It entails collecting and analysing critical information required to evaluate performance, and it forms part of the programme's core reporting system. Data collected as part of core reporting, based on pre-determined indicators developed at the design stage, will provide a basis for **evaluation**. Mechanisms to benchmark and audit outcomes are also required as part of the evaluation system, as are processes to ensure the outcomes are used to inform ongoing programme design and performance management. M&E systems are thus focused at the level of programme performance and need to be integrated into day to day management of the programme.

Evaluation looks at the extent to which the project's outputs have led to the desired results or outcomes (see Figure 1). These outcomes are also known as the project's objectives. Whereas the achievement of the project's outputs (for example, a road) is under the direct control of project management, the achievement of a project's objectives (e.g., the completed road leading to improved incomes through induced farming and trade activities) falls outside the direct control of project management and is assessed through project evaluations. Project evaluations undertaken by the ILO have typically looked at other factors such as the project's institutional arrangements, cost-effectiveness, cost-benefit ratio, beneficiary participation, etc.

Impact assessment is focused on longer term effects. It assesses a programme in relation to its wider policy purpose, in order to inform policy-level choices, such as reduction of poverty or inequality, or stimulation of economic growth or local economic development. Impact assessments are expected to answer these higher level 'purpose' questions.

Impact assessment complements M&E: it relies on baseline data collected before projects started as well as on data collected within the M&E process, but it requires a different set of methodologies, operates on a longer timeframe and may have a different set of users. Impact assessment involves longer cycles. Broader social and economic impacts will take a certain amount of time to achieve and therefore will lag behind implementation to varying degrees. Often impacts will be felt only after project implementation has been completed. Impact assessment informs medium to long-term planning and policy-making, rather than day to day decision-making.

2.3 Management information systems

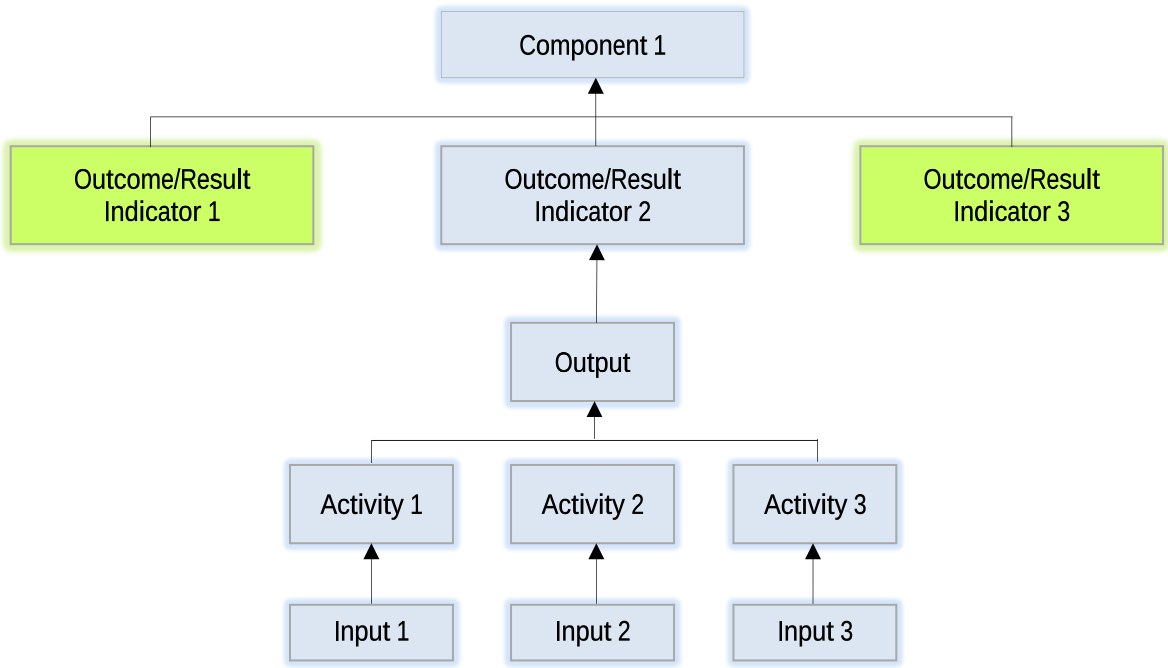
Management information systems (MIS) are designed and customized for managing operations within an organization, and provide a basis for project monitoring and evaluation. MIS guide project implementation and elaborate the results chain, from the project's development objective right down the hierarchical chain to results/outcomes with outcome indicators, outputs, activities and inputs. Thus a MIS not only performs the function of managing project data, but also enables the project management to monitor and evaluate the performance of individual project components and sub-components. Many projects are inherently complex, involve components that have different yield times and require different professional skills to manage. A customized MIS[7] provides an efficient platform for managing such projects and enables the project components to be systematically linked and aggregated to the project development objective. Most donor-supported public investment projects contain the following three components: i) a works component which might be split in sub-components such as infrastructure, environmental works and services, ii) a capacity building component and iii) an institutional/implementation support component.

A professional MIS contains several modules, the core and central one being the project module where all data on components, projects and sub-projects are entered and synthesized. Other important satellite modules are those with the finance data (per source of funding), the contract data and the data base with the different actors intervening in the

[7] A MIS can run on a relational database management system such as Oracle or Microsoft SQL. Microsoft Access platform is only suitable for very low data systems that envisage handling not more than 2 GB of data. There are a few "off the shelf" MIS programmes on the market, but in most cases new MIS should be customized by software programme developers, preferably before the start of the project.

project. Some MIS include a Geographic Information System (GIS) showing where projects are located.

Figure 1. A schematic representation of the results chain in the database management system



The critical requirement of maintaining the integrity of the results chain is ensured through systematic linkage of inputs, activities, outputs, outcome/result indicators in the database. The inputs describe the resources budgeted for each activity or set of activities in the results chain. This linkage is represented schematically in the following diagram.

The diagram illustrates how inputs link to the project components which are ultimately linked to the project development objective. The entries in the database (components, outcome indicators, output, activities and inputs) are coded for ease of data entry and management.

The MIS captures the crucial data into a project reporting system and 'processes' the data in ways that allow for comparison against target indicators – and for performance issues to be flagged and addressed.

2.4 From project monitoring to evaluation

These data-based systems should be complemented by other approaches that audit and verify the data in the MIS system, and that engage in more qualitative evaluation.

The following additional tools or processes described briefly hereafter are often used: technical, financial and socials audits as well as process evaluations. Their outcomes are important inputs to adjust on-going projects in time. They are also key inputs for mid-term and final evaluations of projects.

Technical audits are conducted on an annual basis to check the quality, costs and duration of the works as well as the contracting and payment process. If quality is below normal standards, remedial actions such as on-the-job and classroom training are provided to improve the performance of different actors involved in construction.

Financial audits are undertaken at regular intervals to verify that government rules or financial procedures, usually detailed in an Operations Manual, are respected. The use of transparent financial procedures, and in particular the timely payment of SMEs, CBOs and workers is of utmost importance to guarantee the success of programmes.

Social audits are conducted to assess performance in terms of social, environmental and community goals. They provide a means of measuring the extent to which an organization in charge of a project lives up to the shared values and objectives to which it has committed itself. They provide an assessment of the impact of an organisation's non-financial objectives through systematic and regular monitoring, based on the views of its stakeholders.

Process evaluation is another important part of an evaluation system. A process evaluation assesses whether the programme is being implemented in accordance with its design. From an operational perspective, process evaluations typically assess whether a programme is being implemented in accordance with the processes and procedures specified in the operations or implementation manual. It can then help to identify bottlenecks, areas where procedures are not being followed and give inputs on possible improvements on the process. A typical example may be the identification and selection of projects. The manual may prescribe a process for this in which projects are identified and selected by communities. If the procedures in the design are largely neglected and local officials are in reality in charge of identification and selection of projects, the benefits of the project may or may not accrue primarily to the communities. Other processes often evaluated in PEPs are the methodologies for targeting beneficiaries, reporting and payment processes.

Normally, all public investment programmes should be subject to appraisal, mid-term and final evaluation. These evaluation exercises should either include or support the data requirements of an employment impact assessment.

2.5 From project evaluation to impact assessment

In the analysis of the employment impacts of infrastructure investments, three different stages can be distinguished: i) the implementation phase of the investment, meaning the construction of the infrastructure, ii) operations and maintenance after the implementation of an infrastructure, in order to maintain the quality of the infrastructure and to provide services related to the availability of the new infrastructure, and iii) the longer term effect of a better infrastructure.

Impact assessment is focused on this longer-term effect, i.e., whether the programme is achieving its higher development objective or policy purpose such as poverty reduction. Good programme performance is necessary but not sufficient for this – because a programme may be meeting all its targets, but still not achieving its purpose.

Project impact assessments require good **baseline studies** using measurable indicators rather than reliance on anecdotes, extrapolation and perceptions. Those indicators are measured again after the completion of the project to know its medium or long-term impact, depending on the timing of the impact studies. There are a number of good examples of **socio-economic impact studies** on labour-based rural road projects which explore the following chain of reasoning and impacts. The creation and improvement of rural roads generates a new asset, providing improved access to project beneficiaries. Better connectivity in terms of transport, communication and energy supply and savings has an economic impact (trade, investment), an impact on health (better and faster access to health services), an environmental impact and of course an employment impact. Such studies[8] measure these impacts by tracking the increase in the number of traders, the composition of trade, average travel time to markets, the rise of new forms of travel service, increased access to and exploitation of agricultural lands, the increase in ownership of motorbikes, etc. They also measure the social impacts of the roads: improved use of health services, improved access to water, clinics, schools and district centres in terms of time saved, trips made, and costs saved.

An integral part of understanding employment impacts is the measurement of the social and economic impacts of the income earned by workers who have participated in the infrastructure construction or improvement: how is this income used, what does it enable, where does it go within the local and regional economy or beyond. In fact, these same questions are key for assessing the local economic multipliers of cash-transfer programmes and for comparing the employment and poverty impacts of cash-transfer (social protection) with those of job creation programmes. As training is often an important ingredient in these programmes, employment impacts should also analyse how training has increased entrepreneurs' access to public tenders as well as how it has improved the employability of workers.

Whereas this Guide focuses on short-term growth and employment impacts as measured by input-output based models, other methodologies are available which focus on longer-term impacts including cost-benefit analysis and computable general equilibrium models. These are discussed briefly in Annex 3.[9]

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[8] Some examples include Government of Benin and DANIDA (2006) and van de Walle (2006).

[9] Annex 3 provides a more detailed discussion of tools and models used to evaluate macro-economic impacts of investment programmes, as well as some tools used for micro-economic analysis.

3 Overview of ILO's past research demonstrating the cost advantages of labour intensive approaches

This chapter will provide a brief review of the first generation of employment impact studies undertaken by the ILO's Employment Intensive Investment Programme which have focused on a simple cost comparison based on alternate technology choice options. These studies have provided the foundation for the ILO's current work on employment impact analysis. To better understand the motivation for these studies, it is useful to contextualize the EIIP within a broader employment policy framework. Although labour-intensive infrastructure development was readily embraced as a "special" or temporary measure to address severe unemployment or as an emergency response mechanism, it was rarely taken seriously amongst employment policy specialists as a core element of a policy for sustainable job creation and decent work. Hence there was a felt need for studies which would demonstrate the *sustainability* and *quality* of the jobs created, since labour-intensive employment and infrastructure programmes were often criticized on these two grounds.

The ILO's global Special Public Works Programme, in the 1980s in fact had a dedicated evaluation unit which carried out independent (meaning that programme design and management teams could not participate as evaluators) and joint (involving participation of beneficiary government, donor and executing agency representatives) evaluations systematically for all programmes. These evaluation exercises undertook a broad review of the attainment of project outputs and objectives as specified in the project design according the logical framework described above. Most of these evaluations were comprehensive and participatory, providing qualitative and quantitative analysis of, amongst others:

- Employment created;
- Infrastructure and services put in place, often including cost-benefit analysis;
- Training and capacity building;
- Institutional support;
- Operation and maintenance.

These evaluations ensured accountability of the project management team, including national government officials and expatriate technical assistance for achievement of planned outputs in terms of infrastructure and employment, but furthermore provided an opportunity to bring together key stakeholders (government policy makers, project beneficiaries, national support staff, ILO-United Nations technical assistance backstopping personnel, donor agency representatives) to discuss progress and reorient the programme as recommended. In terms of providing the groundwork for future employment impact assessments, these evaluations provided an invaluable source of data, which subsequently could be used as an input into EmpIA economic models (in particular, input/output tables and social accounting matrixes), in areas such as:

- Cost and quantities of infrastructure creation;
- Unskilled, skilled and supervisory labour inputs including levels of remuneration;
- Labour intensity of infrastructure created, labour as a percentage of total costs;
- Labour availability (supply) in project zones.

Likewise, the ILO's employment and technology programme, which was largely backstopped by civil engineers focusing on the rural road sector and which later merged with the Special Public Works programme to become the Employment-Intensive Investment Programme, produced a wealth of data on employment creation, labour productivity and costing and technical standards of infrastructure which would prove to be invaluable in undertaking employment impact assessments. Additional policy-oriented data which can come out of such studies include data in the cost of creating a work-day (or any other appropriate measure of job creation) of employment or the “break even” wage rate at which point labour- or equipment-based techniques result in similar project costing.

Whereas the specific data requirements of input/output models will be discussed in detail below, project specific data, drawn from both worksite implementation reports, from background baseline socio-economic surveys, and from targeted research on recruitment practices, workers’ consumption patterns, etc., provide invaluable inputs into such models. This micro-level data is then married with official economic and labour statistics for the macro-economy. For example, data on how workers spend their salaries can be used to calculate economic multipliers, including indirect or induced employment created thanks to workers’ salaries paid in employment-intensive infrastructure projects. Multipliers can be expected to be superior in labour-intensive projects for three main reasons: first, the absolute amount of wages is superior in labour-intensive projects when compared with standard equipment-based projects; second, given the fact the labour-intensive projects tend to be implemented by more unskilled labour in low income areas, one would expect that a greater percentage of workers’ salaries be spent on domestically-produced basic needs, with less leakage through imports and greater impact on indirect job creation; and third, labour-intensive projects can be expected to have higher backward linkages (and less leakage due to exports) in terms of procurement and suppliers, which in turn contribute to raising aggregate demand. Of course, all these assumptions do not necessarily hold in all countries and in all situations and need to be tested and verified on a case-by-case basis. For example, Bivens (2013) shows that infrastructure development in the US has lower than average levels of labour-intensity.[10]

A key concept for analysis of labour-intensive projects, commonly used in cost-benefit analysis, is the calculation of shadow pricing. Whereas shadow-pricing can have different applications, in the case of employment-impact analysis, shadow pricing can be used, in the context of cost-benefit analysis, to estimate the rate of return and overall usefulness of a project, either justifying or calling into question the decision to embark on an employment-intensive investment strategy. The main cost components for labour-intensive investments would be cost for labour, equipment and construction materials. In a financial cost benefit analysis the rate of return for an investment programme is calculated based on an amortized (over the expected useful lifespan of the investment) stream of costs and benefits, expressed in financial terms.

In a socio-economic cost benefits analysis, shadow pricing is applied to all costs and benefits. At the risk of oversimplification, in those countries, including most developing countries, which are best placed to benefit from employment-intensive investment strategies, labour is the abundant and underutilized resource, whereas equipment and many construction materials are relatively scarce and often imported. Shadow pricing therefore is used to re-adjust prices in terms of their relative scarcity or abundance in the economy, which in effect would mean decreasing the cost of labour (the relatively abundant resource) and increasing the cost of (usually imported) equipment and materials. Hence one would expect that use of shadow pricing in the case of a labour-intensive investment project would result in further justifying the investment decision made in its favour by lowering its estimated costs (since labour costs represent a greater share of the total investment budget) and hence increasing its profitability or socio-economic usefulness.

Any linkage between the fact that labour is a relatively abundant resource (implying that its shadow price should be lower than its financial price) and wage fixing policy would be reckless and should be scrupulously avoided. The fact that shadow labour costs are

[10] However, this may be due to the fact that measurements of infrastructure include extremely capital-intensive equipment (railroad wagons, ships, airplanes, etc.) which distorts the overall average.

lower than financial costs does not necessarily imply that wages should be lowered. Whereas an analysis of remuneration systems and wage policy in the framework of public investment programmes goes beyond the scope of this study, lowering wage rates (the price of labour) to the point where supply matches demand would be reckless for a number of reasons:

- First, wages levels should respect internationally-agreed labour standards and be determined with respect to the values which underpin them;
- For labour-intensive methods to be "competitive" with equipment-based ones, workers should be productive and motivated by a just and fair level of remuneration;
- There is experience to demonstrate that public employment programmes – including in the framework of an employment guarantee - can be a policy instrument which introduces, generalizes and enforces a minimum wage in contexts where there is strong downward pressure exerted by the informal economy.

Nevertheless, the use of shadow-pricing in terms of cost-benefit analysis can be an important policy tool in favour of a more judicious reallocation of scarce resources, for identifying the economic costs incurred by policies which subsidize equipment (including, for example, overvalued exchange rates and donor's aid policies which donate equipment but do not cover local labour costs) and for justifying policy decisions in favour of an employment-intensive investment strategy.

One straightforward type of employment-impact study which the ILO has commonly undertaken involves a cost-comparison between labour-intensive and equipment-intensive infrastructure projects. Such studies can be based on either financial or socio-economic (i.e., shadow pricing) costs.

One such study (Lennartsson and Stiedl,1995) and a repeat study carried out ten years later (Stiedl, 2005) compared labour- and equipment-based road construction in Lesotho and in Zimbabwe. In order to ensure data comparability between the labour-based and equipment-based roads (i.e., different dimensions, technical standards, type of terrain, ancillary equipment such as guardrails, etc.), a number of adjustments in the actual costings were applied. Also, full shadow pricing is not used, but rather a reduction factor reducing labour costs below the level actually paid in the project to a level in line with the "going wage rates" in rural areas, or as the study puts it, "A more simple (and constructive) proxy has been adopted for this study, which is simply to look at the supply price of labour for the project, that is the price at which labour would accept project employment below the rate imposed by government edict." (Lennartsson and Stiedl, 1995, p. 16.) Furthermore the price of equipment was in some cases estimated to be undervalued and was adjusted accordingly. The two studies yielded the following results:

Table 1. Financial and economic cost comparison of labour-based and equipment-based road construction in Lesotho and Zimbabwe

	Lesotho				Zimbabwe			
	1994		2004		1994		2004	
	LB	EB	LB	EB	LB	EB	LB	EB
Financial cost USD/Km	45,082	96,089	89,357	92,113	13,681	15,427	7,551	8,176
Labour component USD/Km	19,385	5,765	39,317	7,369	4,378	2,006	3,171	1,553
Labour component shadow factor	0.52	0.52	0.50	0.50	0.40	0.40	1.00	1.00
Equipment component USD/Km	No information						1,057	4,579
Equipment component shadow prices	1	1	1	1	1	1	3	3
Economic cost USD/Km	35,777	93,322	69,698	88,428	11,054	14,224	9,665	17,333

The comparison shows that for Lesotho in financial terms labour-based roads cost 93 per cent of the cost for similar roads constructed with equipment-based methods. When the above-mentioned adjustment factors are applied, the economic cost of labour-based methods drops to only 79 per cent of the cost of roads undertaken with equipment-based methods. In the case of Zimbabwe, the cost advantage in financial cost terms is 22 per cent, and in terms of economic costs, it rises to 53 per cent.

Another cost comparison study undertaken in Cambodia (Munters, 2003, p. 45) draws a number of observations and conclusions:

- The overall weighted average cost of labour-based works is 17% lower than equipment-based works, ranging from around 11,000 US$/km for certain categories of labour-based works to around 21,000 US$/km for equipment-based.
- This cost advantage for labour-based works does not depend on the implementation modality (i.e. force account or contracted works): the weighted average cost of labour based projects is consistently lower than equipment-based projects, viz.:
  - When works are carried out using labour based methods force account operations, the cost saving is 9% compared to using equipment based methods.
  - For the contracted out labour-based works, the cost saving is an amazing 37% when compared with equipment based works.
- The third conclusion concerns the large employment potential in rural road works. The average unskilled labour content of equipment-based works is as low as 1% percent of total costs, compared to 37% for labour-based works. Labour-based rural road works require nearly 5,000 unskilled workdays per km as opposed to 200 workdays on an equipment-based operation.

In summary, these "cost-comparison" studies provide an important technical, advocacy and policy tool for informing and guiding projects managers, policy makers and political authorities with respect to public investment programmes. On the technical level, such studies help identify knowledge gaps, improve data collection, improve project design and implementation procedures and increase awareness of how technical decisions impact on project design. On the policy and advocacy levels, these studies demonstrate "how" employment impacts of public investment programmes can be increased through technology choices which often both decrease the overall costs (in both financial and economic terms) and increase the number of jobs created, a win-win situation. Such studies also are an important source of project-level data which is invaluable in carrying out more sophisticated employment impact assessment models (input-output tables or social accounting matrices). Furthermore, these cost comparison studies provide technicians, policy makers and activists with tools to convince or support politicians to make decisions favouring an employment-led growth strategy.

Part II: Methodologies for undertaking employment impact assessments

As opposed to monitoring and evaluation methodologies which work at the programmatic level, employment impact assessments at the macro level have for main objective to influence investment decisions with respect to job creation. EmpIA can simulate potential outcomes of alternative policy scenarios, but can also evaluate the socio-economic (including cost) effectiveness of past policies. The following chapters focus on a core set of diagnostic tools, which are all input-output based. Other more complex economic models, such as general equilibrium models, can also be used to measure employment impacts, are touched on briefly in Annex 3, but fall beyond the scope of this review. This part of the guide will elaborate on the scope of application, the construction, data requirements, practical examples and some policy conclusions of three varieties of employment impact assessment methodologies, namely:

- Input-output models,
- Static social accounting matrices, and
- Dynamic social accounting matrices.

4 Input-output models

4.1 Scope of application

Regardless of the economic context, there is a growing need to understand the impact of public policies and technology choices on employment not just from a project/programme perspective, but also from a macro perspective. In order to demonstrate, or rather simulate, macro-economic impacts of either ongoing or proposed employment-intensive investments, the ILO has developed analytical tools, namely input-output types of models constructed for countries of different level of development. These models, designed with the specific objective of providing economic justification for programme development in the field of labour-intensive investments in developing countries, have broader applicability for linking employment to investment policies in a wide range of countries and contexts.

The input/output model, introduced originally by Wassily Leontief (1936), is generally used to make economic analyses on the impact of economic policy measures (investment, public finance, trade policy) on productive sectors and on economic agents (households, State). An input/output analysis provides a static view of the structural relationships between the various sectors of an economy for a certain period of time, usually one year[11].

In the literature, the areas of application of input-output models are diverse: technological change, international commerce, employment, public finance, transport, industry, agriculture, services, to name a few. Input-output tools are widely used in many countries for policy planning and development. Furthermore, these models can be used at regional, national or multiregional levels. By way of illustration, an input-output model has been used in the United Kingdom to evaluate the impact of investment on productivity (Gossling, 1975) and the impact of technology changes on employment and the economy. In the United States the model has been used to explain structural changes in the economy as brought about by the changes recorded in final demand. Kanemitsu and Ohnishi (1989)

[11] In European countries, I-O tables are updated every five years with data from EUROSTAT since changes in the structure of the economy are not rapid enough to warrant annual updates.

use an input-output model on the Japanese economy to prove that the fall in the price of goods was due to technology changes. In Australia, a dynamic input-output model has been used to simulate and evaluate the skills and labour market challenges which would be brought about by a strategic change towards a green economy (Hatfield-Dodds et al., 2008). I-O models were used in Egypt, Jordan, Morocco and Tunisia to assess the employment outcomes of the European Investment Bank’s infrastructure portfolio in those countries (El Ghrib, 2014; El Kadhi, 2014; El-Megharbel et al., 2015; Omari, M. et al, 2014).

4.2 Definition and theoretical framework of the input-output model

The input/output model is a model for the allocation of demand amongst economic activities in the sense that it can be used to evaluate the impact of economic policy decisions (investment, taxes) on economic aggregates. The model is constructed so as to take account of the interactions between the various sectors of the economy, including not only the direct effects of an employment-focused investment policy, but also allowing evaluation of the impact of indirect effects on the rest of the economy (how it then impacts on production, public finances/tax collection, foreign trade). These impacts are evaluated at the macroeconomic level in terms of GDP, domestic income, domestic consumption, private investment, public debt and the balance of trade. It is therefore possible to simulate various scenarios for infrastructure projects (short or long term maintenance, rehabilitation or construction).

The structure of the input-output model allows, for example, a comparative analysis of the technical choices in an employment-intensive or equipment-intensive investment programme and constitutes an alternative framework for simultaneous analysis of the foreseeable consequences of several economic policy scenarios. It is also possible to make ex post evaluations of various economic policy measures and public programmes.

The input-output model used to evaluate the impact of infrastructure investment projects is a short term macroeconomic simulation model of the Keynesian type. It is based on input-output tables, an accounting framework summarizing all inter-industrial exchanges within an economy and with the rest of the world. In the inter-industry matrix, column entries typically represent inputs to an industrial sector, while row entries represent outputs from a given sector. This format therefore shows how dependent each sector is on every other sector, both as a customer of outputs from other sectors and as a supplier of inputs. Each column of the input–output matrix shows the monetary value of inputs to each sector and each row represents the value of each sector's outputs.

Using such a frame of reference carries the advantage of being able to include all the interactions between the various sectors of the economy. However, the model is static and describes the structure of one specific year. Moreover prices are fixed, meaning that the model cannot represent the real world phenomenon of prices changing in response to changes in supply or demand. The model includes the hypothesis of non-substitution in the short term of the production factors labour and capital in the sense that a simulated shock does not lead to reallocation of these two factors.

The model takes the form of a collection of simultaneous equations which describe the behaviour of economic agents. The principal agents are households, private enterprises and the State.

It models their behaviour on the basis of input-output tables for a given year, showing the structural balance between the supply of resources or inputs (such as construction materials, tools, equipment, labour, etc.) and the use of products or outputs (such as completed infrastructure, for example, roads, irrigation networks, etc.) according to the origin of the resources with which they were built (imported or local). The usefulness of this model lies in its ability to make a clear distinction between origin and production flow. This distinction is particularly useful in a comparative analysis of employment intensive versus equipment intensive approaches as it isolates the effect of imports on employment in particular and on the economy in general.

4.3 How the model works

The model displays the inter-dependencies that arise following a public investment in a typical Keynesian flowchart where global demand results in either imports or domestic production. The latter creates multipliers which in turn affect demand through distributed income. The standard circuit of "production-income-demand" reproduces the effects of multipliers. The model is then resolved to achieve a new equilibrium. This may be compared to the initial equilibrium in order to determine which elements have been affected and to what extent.

Construction of the model

The model is constructed according to a standard procedure which involves data collection, specification of the equations, calibration of the model and simulation. Input-Output tables are normally considered as "open" – that is, restricted to output and employment created directly through investment spending on the intended project or activity, and indirectly, through the procurement and the supply of goods and services to the investment project, but not reflecting induced economic activity and employment as workers spend their earning as well as government revenues through tax collection. In the open I-O model all categories of final demand are exogenous. This implies that there is no feedback from factorial income into demand for goods and services, which results in underestimating the multiplier effect as well as underestimating employment impacts by omitting induced employment. In fact, an I-O table just reflects monetary value; one is the labour cost or the wage bill for specific economic sectors. The wage bill reflects the number of workers times their earnings for the construction of a specific good or service. In order to calculate an employment multiplier, an employment module or satellite account has to be created. The employment data have to be harmonized with the economic sectors of the I-O tables.

Households earn incomes (at least partially) in payment for their labour inputs into the production process. Furthermore as consumers, they spend their income on various goods produced by the economy. Analysing the impact of sectoral output change, it is important to examine the change in the amount of employment required for this new production activity to take place. In addition, an increase in labour inputs due to increased output would also generate new income which would then be spent (partially, depending on the consumption share of income) by households. The problem caused by omitting these feedback loops is partially tackled in the closed I-O table by making household consumption endogenous.

Using this closed I-O model one can derive "complete"[12] multipliers, which allow for the evaluation of economy-wide effects within a more articulated economic structure, e.g. including the effects triggered by changes in the remaining final demand categories (government consumption, exports and capital formation), defined as exogenous, on the sectoral production structure. Following the circular economic flow further effects can be measured, e.g. in the first place, on factorial incomes and household incomes, and secondly, the feedback effects of household consumption on production. The "complete" multipliers

[12] or Leontief type II.

derived from the "closed I-O model" (O'Connor and Henry, 1975) as a result of the income feedbacks are greater than the "partial" multipliers[13] derived from the open I-O model. In addition, it is an equilibrium model, where all values finally have to end up in an equilibrium.

Although "closing" the I-O tables yields a model that is somewhat more comprehensive and encompassing, e.g. by making endogenous a large part of the economic cycle household demand → production → factor income → demand → production, it still does not capture those effects of institutions on income distribution and transfers, neither does it show the sources of capital formation and savings nor the financial flows among and within domestic institutions and the rest of the world, aspects that are all explicitly introduced as part of a SAM.

Another variation of closed I-O tables, which are static, representing one point in time, a specific year, are sequential I-O tables as applied in a recent ILO/EIB study on infrastructure investments in Morocco (El Ghrib, 2014). It is a multi-sectoral model with sequential dynamics covering the period 2003-2012. It is composed of a time series of static I-O models describing for each of the years of the duration of the study the equilibrium of the production system and of the goods and services market.

Data collection

The first data to be collected come from the national accounts. This data will be used to construct a "supply and use" table (see glossary) which is then converted into an input-output table. The input-output table, which is the reference accounting framework used in input/output models, analyses each of the products in the national nomenclature of economic activity types according to its origin (domestically produced or imported) and its destination (input into a subsequent production process, final consumption, export, investment). Generally, input-output tables which draw on data taken directly from the national accounts do not lend themselves to the construction of a model limited to and focusing on employment, or for that matter other types of, impacts. To add this dimension, the data drawn from national accounts should be aggregated or allocated differently in order to achieve the required structure.

At this stage one might be confronted with two types of problem: the process of aggregation and the construction of a balance between resource and product use depending on the origin of production.[14] With regard to aggregation, in nearly all cases the input-output table obtained from the national accounts gives a disconnected and often unnecessarily detailed view of the economic sectors. It might therefore be necessary to aggregate sectors from the national accounts in order to make a more coherent classification of the economy, appropriate for the task of employment impact assessment, and to construct a new input-output framework. For example, an input-output model commissioned by the ILO for Cameroon (Yemene, 2006, see below), which was constructed specifically to evaluate the impact of labour-based infrastructure approaches in the construction sector, divides the economy into nine sectors of activity.

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[13] In addition to that, only in an I-O framework, T1 and T2 multiplies can be considered regarding the relationship between total effects and direct effects. Whereas T1 is defined as the sum of direct and indirect employment divided by direct employment; T2 equals the sum of direct+indirect+induced employment divided by direct employment. Therefore, whereas T1 is more related to partial multiplier effects, T2 is linked to total multiplier effects in a closed I-O model.

[14] Generally, a resource is defined as a factor of production (i.e., labour or capital) while a product refers to a commodity.

Furthermore it is possible – and this is the most common situation – for the input-output table obtained from the national accounts not to distinguish the origin of production (domestic or international) in establishing the balance between the production of resources and the use or consumption of products or outputs. If this is the case, then it is necessary to further process data on imports so as to distinguish between resources produced domestically from those imported, on the one hand, and products used or consumed domestically from those exported, on the other hand. This process then permits one to identify resources (inputs) and products (outputs) of foreign origin, to deduct these from the input / output totals reflected in national accounts and therefore derive the balance for internal (domestic) goods. Furthermore the model allows us to evaluate the content of national production in terms of added national value and the import value of each product, essential information in an employment analysis.

Use of an input-output model for employment impact assessment allows one to make the necessary distinction between various technological approaches, as well as alternative investment strategies, e.g. focusing on "green jobs." This is captured by the model in the cost structure. The costing for investment in any chosen area of economic activity has to be broken down into local costs (wages, profits,[15] materials, equipment and tools) and foreign costs (cost of imported equipment, materials, etc.). A cost structure of this kind is arrived at using micro data derived from the execution of different investment projects of the same characteristics as those being evaluated. Given that most national governments have limited data on employment-intensive projects, this data is often drawn from activity or evaluation reports, or technical audits of labour-intensive projects (see Chapter 3 above). This structure allows us to make a comparative analysis of the impact of various technology alternatives.

Accurate measurement of the labour-intensity of different technological options for implementing infrastructure investment programmes is an important dimension of infrastructure investment programmes. As has been shown above, infrastructure investments in developing countries may be biased towards the use of heavy equipment – due to, for example, overvalued currency, import subsidies or foreign aid policies, whereas the ILO has demonstrated that labour-intensive approaches can be both cost-effective and result in good quality infrastructure. On the other hand, a recent study undertaken in the United States (Bivens, 2014) has shown the labour-intensity of infrastructure to be less than economy-wide averages. However, this may be the result of a labour-intensive low-wage service economy in the US, plus the fact that infrastructure costing figures include the cost of capital-intensive equipment (such as railroad carriages, ships, etc.) produced by the manufacturing sector in addition to construction activities per se.

Model specifications

The model can be built to assess both the direct and indirect effects of investments undertaken with either labour- or equipment-based technologies in terms of output and employment. These impacts are measured with variables including gross domestic product (GDP), household income, household consumption, private investment, the budget deficit, the trade balance and, of course, employment.

GDP is endogenous and is determined from the supply and use compilation and balancing framework (see above under Data Collection and in the glossary). *Intermediate consumption* (see glossary) is determined by supposing that the *technical coefficients* (see glossary) are fixed. The production function is therefore linear with constant coefficients, which of course is one of the model's limitations.

[15] i.e., gross profit of any company contracted to execute the works.

Consumption depends on the marginal propensity to consume of household disposable income. *Gross domestic income* is determined by expenditures. It is a function of the elements making up demand, to which are added net transfers from elsewhere in the world. Part of this gross income is paid to the State in the form of income tax and the remainder constitutes the disposable household income.

The model assumes that not all disposable household income is consumed, but some part is saved and some invested. The model assumes that private investment is determined by a fixed proportion of commercial GDP. The rate of private investment is assumed to be fixed. The model also assumes that public investment is exogenous.

Government income or *revenue* is derived from taxes. The rate for the different taxes (value added tax, import tax, income tax, etc.) are derived from model data. These rates are computed by dividing different tax revenues by the corresponding amounts or volumes of different taxable categories (i.e., consumption, income, property, etc.).

Imports depend on the marginal propensity to import (relationship between imports and GDP). This coefficient is calculated from the model.

Directly created employment is calculated on the basis of income distributed in the form of remuneration and the average level of remuneration for each project.

Indirect employment created in each sector of activity is estimated by taking output generated indirectly (or value added) and dividing it by the labour productivity ratio (for this sector).

Balancing and calibrating the input-output model

In building an I-O model, the modeller is required to drawn on a multitude of data sources in order to gather all the necessary information since a single data source does not meet all the data requirements. During that process, the modellers must address possible (and likely) data inconsistencies (different coverage, methodologies of data collections, etc.) and balance each single account within the model's framework in order to guarantee consistency in totals, which means that output and expenditure have to be identical. Additionally, one also must balance all of the model's output and expenditure accounts with closure rules such as fiscal balance, trade balance and net savings at macro level. Model calibration is then required to ensure that all the data available fits within the model's key structure which will form the basis for further simulations. An employment module is needed for the construction of employment multipliers. Sectoral employment data have to be collected and then harmonized with the structure of the I-O tables, economic sectors (same year, same classification, etc.).

Simulation

The final step involves using the model for simulation. Once the above steps have been carried out, the model can be used to simulate policy interventions (such as injection of different public investment scenarios), by changing certain parameters and measuring their impact on key variables (in the case of this guide, the focus is changed in output and employment).

4.4 Practical applications

The first generation of models used by the ILO to carry out a comparative analysis of the economic and employment impacts resulting from different technological approaches to infrastructure investments are based on input/output models.

Cameroon

In Cameroon, this type of model was constructed to simulate the impact of public investment in the roads (Yemene, 2006, 2009) and building (Yemene, 2010) sub-sectors on employment and on the economy in general. The results encouraged the Cameroon government to develop a strategy for the promotion of the labour-based approach in its priority investment programmes including in the sub-sector of rural roads. Since the country had no prior experience in support of a labour-based approach for infrastructure development, such evidence furnished by this model persuaded national authorities to set up an ambitious labour-based infrastructure investment programme to combat unemployment.

The principal lessons learned from these models are:

In the roads sector, and particularly which respect to rural roads which offer the greatest potential for substituting labour for equipment, the model demonstrated the superiority of labour-intensive over equipment-intensive works with regard not only to the creation of jobs, but also with respect to economic output, tax revenues, domestic income and consumption and private investment. Using the same overall investment budget, the model simulated two scenarios, the second of which where the amount spent on wages on labour-based worksites is 7.5 times greater than the amount spent on equipment-intensive sites. Compared with conventional equipment-based methods, the wages distributed on a labour-intensive site engender twice the amount of household consumption within the overall economy. This direct employment of labour intensive methods also has a much greater multiplier effect, leading to the creation of 2.3 indirect jobs for every direct job created. The corresponding multiplier for equipment-based methods is only 0.67. The rate of growth, not surprisingly, is higher in the employment-intensive sectors, particularly tertiary, primary as well as for construction and public works.

By way of illustration, one billion CFA francs invested in labour-based works:

- Creates nearly 3,100 jobs, of which 856 are direct;
- Increases GDP by 0.02 per cent or 2.9 times more than an equipment-based approach;[16]
- Raises domestic consumption by 0.02 per cent or 2.1 times equipment-based technology;
- Increases domestic income by 0.03 per cent or 2.08 times more than an equipment-based approach;
- Has a multiplier effect of 2.26 on the economy as a whole compared to 0.67 for an equipment-intensive approach.

[16] The relatively small absolute figures are understandable in view of the relatively small amount of this simulated investment programme (1billion CFA francs or about 2.1 million USD at 2009 exchange rates) with respect to the size of the entire economy.

Table 2. Comparative analysis of a one billion CFA franc investment programme undertaken either by labour or equipment-based methods

Impact measured in terms of percentage growth	Equipment-based	Labour-based
GDP	0.007%	0.020%
Domestic consumption	0.010%	0.021%
Gross domestic income	0.013%	0.027%
Private investment	0.001%	0.003%
Tax revenue	0.0026%	0.0033%
▪ Consolidated taxes	0.0003%	0.0005%
▪ Tax on imports	0.0019%	0.0020%
▪ Income tax	0.0004%	0.0008%
Imports	0.007%	0.007%
Employment rate of growth	0.016%	0.035%
Job creation	1 427	3 114
▪ Direct employment	84	856
Multiplier	0.67	2.26

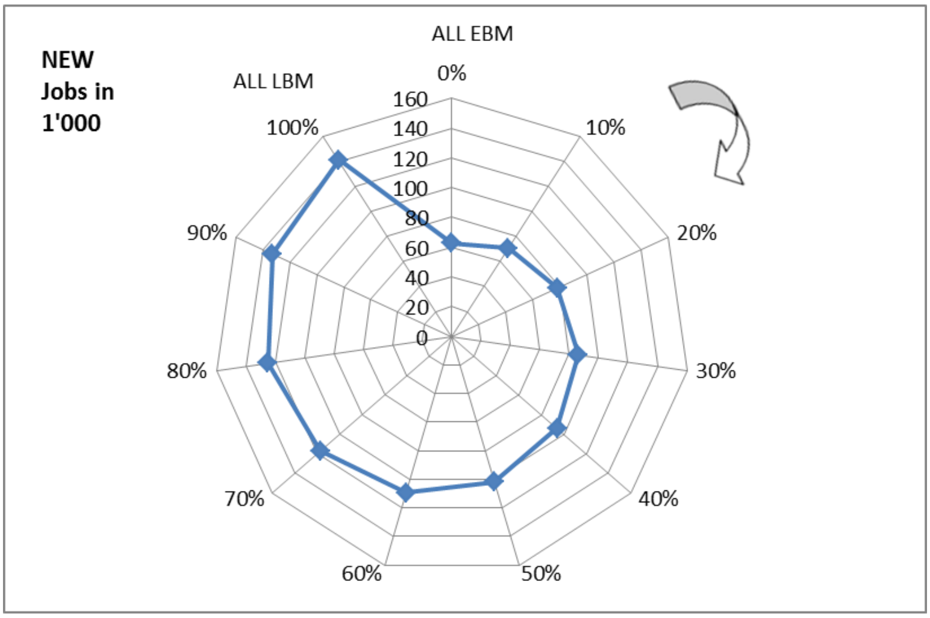
Source: Yemene et al. (2009).

An analysis of a simulation whereby the investment budget intended for equipment-intensive projects is reduced by ten per cent (five billion CFA francs) and the corresponding funds are diverted to the rehabilitation of rural roads under a labour-based approach, shows that:

- GDP increased by an additional 0.07 per cent,
- Consumption by 0.05 per cent,
- Gross domestic income by 0.07 per cent.

The chart below presents the results of this employment analysis and provides a useful tool to assist in planning and programming labour-based infrastructure projects.

Figure 2. Impact on employment of variation in the funding of an EIIP programme



Source: Yemene et al. (2009).

To analyse the impact of the labour-based approach on the building sector in Cameroon, the model distinguished three categories of building: Building with elementary finish (BEF); Building with moderate finish (BMF); and Building with luxury finish (BLF). The breakdown of building construction into these three different categories is justified by the fact that a different technology is used for the construction of each category. BEF offers the best possibility for the use of an employment-intensive approach; and BMF would use a mixed technology combining equipment and labour-based methods, while BLF will be suitable for an equipment-based approach.

The results in the building sector show that:

- The multiplier effect (on the economy) of investment in the using labour-based approaches (1.46) is greater than that using an equipment-based approach (1.19).
- The number of jobs created is 1.2 times greater using labour-based technologies than using equipment-based technologies.
- Globally, 1 US$ added value obtained directly in the construction of public buildings generates US9 US$ added value in the economy as a whole.
- One job created in the construction of public buildings enables the creation of 6.6 permanent jobs in farming and fishing, 1 permanent job in the manufacturing industry and 2 jobs in services.

Table 3. Comparative analysis of the employment impact of a ten billion CFA franc investment programme in the building construction sector in Cameroon

	BEF		BMF		BLF	
EMPLOYMENT RESULTS	Total no. of jobs	Direct employment	Total no. of jobs	Direct employment	Total no. of jobs	Direct employment
Farming and fishing	11 484		6 651		9 711	
Forestry	252		118		168	
Mining industry	11		7		5	
Food industry	955		556		817	
Wood industry	179		83		112	
Other manufacturing industries	820		576		839	
Construction and public works	1 993	1 800	1 576	1 498	1 180	1 021
Commercial services and trade	2 348		1 476		2 260	
Non-tradable services	749		431		630	
Total	*18 791*	*1 800*	*11 475*	*1 498*	*15 723*	*1 021*

Legend: BFE: Building with elementary finish; BFM: Building with moderate finish; BFL: Building with luxury finish. Source: Yemene (2010).

Madagascar

A similar input-output model was used in Madagascar to simulate employment impacts of a 50 billion MGF[17] (investment programme in the road construction sector in 1999 (Razafindrakoto, 1998). The number of jobs created was 2.2 times higher for those implemented with labour-intensive methods as compared with capital-intensive methods. The same comparative advantages can be found for growth in income and in domestic consumption. Furthermore, implementing labour-intensive works results in a greater increase in State revenue through taxes.

[17] Equivalent of 40 million USD, accessed at: http://data.worldbank.org/indicator/PA.NUS.FCRF?page=3.

Table 4. Macroeconomic impact of a 50 billion MGF public investment programme in Madagascar

Billion MGF	Labour Intensive			Equipment Intensive		
	Direct effect	Indirect effect	Total	Direct effect	Indirect effect	Total
GDP	28,0	30,0	58,0	20,0	14,1	34,1
Consumption	9,4	30,7	40,1	2,5	15,3	17,8
Domestic income	11,5	36,9	48,4	3,0	18,5	21,5
Public deficit	-46,4	+3,1	-43,3	-45,3	+1,4	-43,9
▪ Public spending	-50,0	0,0	-50,0	-50,0	0,0	-50,0
▪ Public revenue	3,6	3,1	6,7	4,7	1,4	6,1
o Tax on imports	3,4	1,7	5,1	4,6	0,7	5,3
o Tax on goods and services	0,1	0,9	1,0	0,1	0,4	0,5
o Income tax	0,1	0,5	0,6	0,0	0,3	0,3
Balance of trade	-22,0	-11,2	-33,2	-30,0	-4,8	-34,8
Job creation	8580	16120	24700	2240	7850	10090
Multiplier			2.07			1.70

Source: Razafindrakoto, 1998.

India

A closed input-output model was used in India to analyse employment impacts of infrastructure projects at the state level (i.e., decentralized analysis) in India. This study prepared by National Council of Applied Economic Research (NCAER) (Sinha et al., 2015) for the ILO tries to understand the impact of key infrastructure sectors on employment creation (quantity and quality) in two Indian states, Gujarat and West Bengal.

The study involved developing for each of the two states a set of economy-wide employment multipliers (direct, indirect, and induced) for selected infrastructure (national highways/urban roads, rural roads, buildings and irrigation canals). The purpose of the study was to analyse the job creation and growth potential of these infrastructure sectors. The multipliers are developed by using input-output models that are derived following the construction of state input-output tables with sixteen basic sectors plus the above four new infrastructure construction sectors for the year 2009-10. The regional/state input-output tables were prepared applying a hybrid method by using surveys for selected sectors together with secondary data and expert knowledge collected from both national and local levels (Sinha et al., 2013).

The input-output model is 'closed' as the national accounting cycle is completed by incorporating household consumption of each output or product as a further injection leading to induce growth and employment. This closure allows the measurement of the induced employment effect.

The following results concern multipliers of both economic output and employment creation. Multipliers derived from "open" input-output tables concern direct and indirect (i.e. supplier effects) impacts only and are known as Type I multipliers. Multipliers which in addition to the direct and indirect impacts also included induced inputs (i.e., relating to the spending carried out by workers involved in both direct project activities and indirect activities concerning with supplying goods and services) are derived from "closed" input-output tables and are known as Type II multipliers. Furthermore, the results concern not only the four infrastructure categories listed above, but also two categories of workers, namely, formal and informal.

The policy conclusions as taken from the draft report (Sinha, et al., 2013, pp. 6-7) are as follows:

The employment analysis shows that the Rural Road Construction has the highest labour intensity, followed by Irrigation Canal Construction, than Highways and Urban Road Construction and lastly by Building Construction. Similarly, it is informal workers which have a higher share in employment in these infrastructure sectors respectively.

In both the states of Gujarat and West Bengal the employment multiplier for informal workers is higher than that of formal workers, except in the public administration sector. In Gujarat, the highest informal employment multiplier is in wooden furniture and fixtures (2.69) followed closely by rural roads (2.52) and agriculture (2.29). The lowest informal employment multipliers are in public administration and petroleum products. The study reveals that of the relevant infrastructure sectors in Gujarat, rural roads construction creates the most of employment and most of that again is informal employment.

In West Bengal, the highest employment multiplier is of irrigation canal construction (3.76), followed by rural roads construction (2.82) and Highways and Urban Roads (1.38). The employment multipliers in these sectors are driven by informal employment again. Of all the sectors, the lowest informal employment multiplier is of the public administration sector as expected. Interestingly in West Bengal most of informal employment is created in irrigation canal construction (which mainly on account of repair and maintenance) followed by rural roads.

The overall findings show that buildings are the most productive construction sectors for both the economies. The employment structure within the key infrastructure sectors under focus for this study shows that buildings construction takes most of the workers within these sectors in both the states. These shares are as high as 69 per cent in Gujarat and 74 per cent in West Bengal.

Whereas overall simulation findings reveal that the maximum employment is generated for informal workers, a 10 per cent increase (exogenous shock) in final demand for (i) canal irrigations construction sector leads to a 0.07 per cent growth in Gujarat's economy and a 0.01 per cent growth in West Bengal, (ii) highways/urban roads construction sectors leads to 0.07 per cent growth in Gujarat and 0.09 per cent growth in West Bengal, (iii) rural roads causes 0.01 per cent growth in Gujarat and 0.02 per cent growth in West Bengal, (iv) buildings construction sector results in 1.04 per cent growth in Gujarat and 1.24 per cent growth in West Bengal.

The IO models developed at the state level could be used as examples for other states in developing their IO tables to answer questions about relative investment choices across the various infrastructure sectors chosen for this study, i.e., National Highways, Rural Roads, Buildings, and Irrigation Canals.

Benin

In Benin, an input-output model constructed in 2008 simulates the comparative impact of technology choice (i.e., labour-intensive compared with equipment-intensive). The model underlines the importance of the knock-on effect resulting from indirect (supplier) and induced (from labour spending on earnings) in the labour-intensive approach in the rural roads sub-sector (Yemene, 2007). Twelve times more jobs were directly created by using labour-intensive techniques in the rehabilitation of rural roads than by using equipment-intensive methods. Each direct job created led to 3.4 additional indirect jobs. The income paid directly in terms of wages and salaries in an employment intensive project is seven times more than in an equipment intensive project. Although not all of this additional income is spent on consumption, it nevertheless generates three times more consumption, which substantially boosts the multiplier. Moreover there is a significant foreign exchange saving using labour-intensive methods (calculated at more than 41.7% using the input-output model).

4.5 Requirements for developing an input-output model

To construct such a model requires data collection and surveys at national level which only a specialised organisation with the right technical skills and financial means would be in a position to carry out. Furthermore, when developing a simulation tool, it is always preferable to use official data validated by government or other legal entities. The construction of the model requires country-specific data including:

- All the spending and consumption, or input and output, data broken down by relevant economic sectors required for the input-output table,
- Macro-economic data on areas such as balance of payments, imports and the various technical coefficients (such as labour productivity, marginal propensities to consume or to import, etc.), and
- A breakdown of investment costs into different spending categories (for example, wages per category of worker, equipment, tools – whether imported or produced domestically, operation and maintenance, overheads, etc.) estimated from sample project data.

At the same time, processing the data and collecting supplementary information according to the needs of the model requires skills in data processing. One specialist would be needed to adapt the accounting framework to the requirements of the model, another specialist would be needed for data collection and a further[18] specialist would be required to fine-tune the model as such. Spreadsheet software is entirely suitable for the task.

4.6 Strengths, limitations and challenges of input-output models

Undertaking an employment-impact assessment using an input-output model has the following advantages:

- The results of an input/output model are relatively easy to understand and communicate to policy makers.
- The model is based on concrete relationships between economic branches, so that it is possible to evaluate the direct and related effects of an infrastructure project on other sectors of activity and on the economy as a whole.
- It is possible to simulate alternatives for an infrastructure project: short/long term maintenance, rehabilitation or construction.
- The foreseeable consequences of two different technologies (labour and capital based) may be analysed simultaneously, followed by a comparative analysis.
- The model does not require a large number of hypotheses: it does not depend on the subjective view of the model maker to set the parameters.
- The model does not require a vast amount of data: one financial year is enough. This avoids approximation, which could lead to false results. From this point of view, the model is ideal for a developing country, where there is usually a lack of statistical information.
- The model is easy to use, easy to update and easy to calibrate, resolve and interpret.
- It uses readily available spreadsheet software.

[18] See for example, the process used and requirements for developing an input-output model in Madagascar (Razafindrakoto, 1998).

The limitations of this type of analysis are:

- An input-output model is static[19] and used fixed prices, so that one cannot take account of the time factor. In particular, any modifications in the behaviour of enterprises or consumers cannot be taken into consideration, nor does the model take into account changes in technical coefficients such as labour productivity or possible substitution between labour and capital.
- The model is limited to the real external sector of the economy and does not take monetary aspects into account. In other words, the model is based on volumes and does not take into consideration price changes of inputs and outputs.
- The model does not include the reactions of economic agents to a modification of their environment.
- The model does not allow simulation of external circumstances caused as a result of the project. One may suppose, for example, that the construction of a road linking a village to a market would result in reduced transport time and lower transaction costs, and eventually in a rise in farming income and more competitive prices for agricultural products in the village. The fact that the model does not take these external factors into account means that the real impact of a project may be underestimated.
- The model is limited in that it is based on a truncated economic circle of a country. For example, unless the model is closed, it does not include induced output and employment effects brought about by household earnings, nor does it include transfers within and between different economic actors (i.e., households, government, enterprises and the rest of the world).
- The model, when compared with a SAM, does not allow a detailed analysis of the impact of infrastructure works on poverty, as it does not include social transfers between the economic agents (e.g. remittances sent to family members, donations by companies to charity organizations).
- There are no supply side constraints. In other words labour and capital are in sufficient supply to respond to increased demand brought about by the project.

What are the challenges for this type of analysis?

An input-output model is relatively simple to use, once a recent I-O table with sufficient disaggregation is available. The major challenge is the availability and quality of the data required to construct the model. It is preferable for the data to come from official sources in order for the simulations to be empirically validated, because the model is going to be used for policy decisions. While there is considerable experience in the infrastructure sector, this type of analysis could already be applied to other sectors, in order to compare employment intensity between the sectors or to compare technology choices within other sectors. The model can be improved by “closing” I-O tables thus including the economy-wide effect, by sequential I-O tables allowing time-series analysis and by disaggregating it down to the provincial level, taking into consideration provincial characteristics.

In conclusion, input-output models can improve various development partners’ understanding of the impact of public policies and technology options on employment and other economic variables. However, the model does not go into distributional effects meaning, for example, that it does not breakdown project benefits according to different levels of earnings or different categories of workers.

[19] A sequential I-O model, however, allows time-series analysis (see El Ghrib, 2014).

5 Static social accounting matrices

5.1 Theory

Definition and description of the method

Since investment is a component of the national aggregate demand, a “Keynesian” type of demand driven (multiplier) approach such as the Social Accounting Matrix (SAM) with an accounting platform provides an excellent methodology for undertaking employment impact assessment. A SAM can be considered as an extension of the input-output models, described above, which have been used extensively by the ILO in recent decades to measure the direct and indirect employment impacts of public investment through a multiplier analysis. The major drawback of input-output tables is that they do not include any detailed data on the distributional side of economic processes and rarely include the induced effect through higher income.[20] That is, they do not contain data on the expenditure pattern of the economic actors (governments, enterprises, and households) and only describe a truncated socio-economic circle of a given country. In the context of employment impact analysis, this means that while input-output models tell us about overall and sectoral impacts of investment resources on economic activity, the SAM can also answer questions about which type of workers or households benefit most or least from public intervention and to which degree.

A SAM is a square matrix (with equal number of rows and columns) providing an accounting framework that represents an economy’s flows of income. A SAM (see Figure 3) coherently brings together data on income creation and on economic production taken from national accounts and from input-output tables, and also, unlike an input-output table, includes information on transactions and transfers of incomes by all economic actors of an economy and by the foreign sector.[21] As shown in Figure 3, the input-output table and the SAM are founded on the central production diagram of inputs and outputs whereas social transfers and institutions are elaborated only in a SAM and constitutes its added value. For a more detailed description of a SAM framework, see Table 5 taken from Thorbecke (1988).

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[20] The exception are closed I-O tables, which can be considered as simple SAM models not reflecting distributional aspects.

[21] A SAM, therefore, displays the following elements: 1. Inputs; 2. Outputs; 3. Factor incomes created in domestic production; 4. Distribution of these factor incomes; 5. Redistribution of these factor incomes over different institutions, 6. Expenditure of these institutions on consumption or on investment, 7. Savings made by them. It is a single entry system. For more information, see van Heemst, Ch. 1, in Alarcon et al. (1991).

Figure 3. Input-output table and SAM

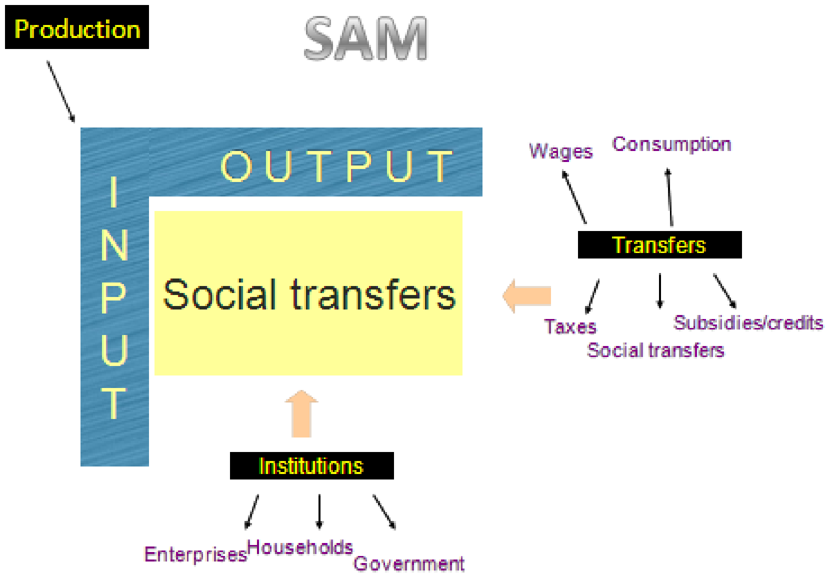


Figure 4 (below) illustrates the economic flows represented through a SAM between the production side, factors and factorial income distribution and the final demand by different actors. In a SAM, a distinction is made between activities which produce commodities and commodities which are goods and services produced by the activities. The distinction is important in a SAM framework, as an activity may produce more than one commodity as well as a commodity may be produced by more than one activity. The activity of sugar cane processing leads to two products, sugar for food and ethanol as a fuel for cars, for example. Likewise, toys for kids can be made by wooden product manufacturers -or craftsman- as well as by plastic product manufacturers.

Table 5. A basic social accounting matrix (SAM)

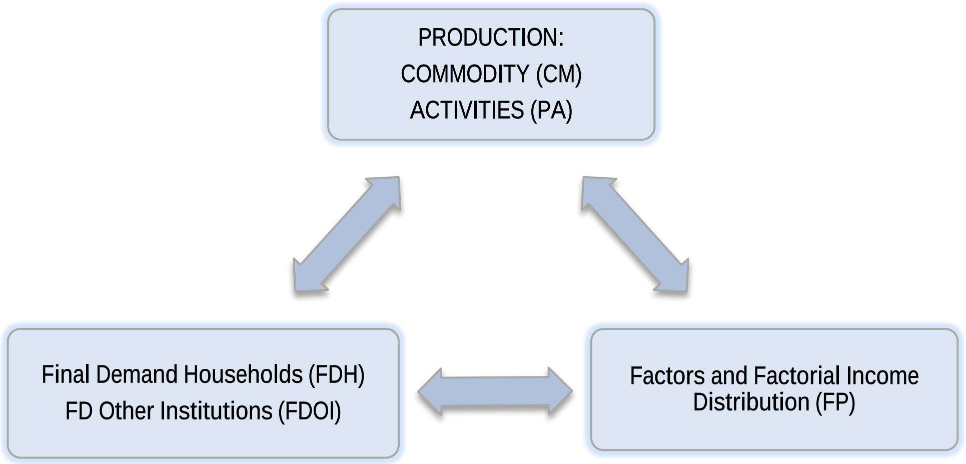
		Expenditures							
		1	2a	2b	3	4	5	6	
		Factors of production	Institutions: Current accounts: Households	Institutions: Current accounts: Companies	Institutions: Current accounts: Government	Institutions: Combined capital account	Production activities	Rest of the world combined account	Totals
Receipts	1 Factors of production						Value added payments to factors	Net factor income received from abroad	Incomes of the domestic factors of production
Receipts – Institutions – Current accounts	2a Households	Allocation of labour income to households	Current trans-fers between households	Profits distributed to domestic households	Current trans-fers to domestic households			Net non-factor incomes received from abroad	Incomes of the domestic institutions after transfers
	2b Companies	Allocation of operating surplus to companies			Current trans-fers to domestic companies				
	3 Government		Direct taxes on income and indirect taxes on current expenditures	Direct taxes on companies plus operating surplus of state enterprises		Indirect taxes on capital goods	Indirect taxes on inputs	Net non-factor incomes received plus indirect taxes on exports	
Receipts – Institutions	4 Combined capital account		Household savings	Undistributed profits after tax	Gov't current account surplus			Net capital rec'd from abroad	Aggregate savings
Receipts	5 Production activities		Household con-sumption expend. on dom. goods		Gov't current expenditure	Investment expenditures on dom. goods	Raw material purchases of dom. goods	Exports	Aggregate demand - gross outputs
	6 Rest of the world combined account		Household con-sumption expend. on imp. goods			Imports of capital goods	Imports of raw materials		Imports
	Totals	Incomes of the domestic factors of production	Total outlay of households	Total outlay of companies	Total outlay of government	Aggregate investment	Total costs	Total foreign exchange receipts	

Source: Thorbecke (1988)

5.2 Construction of the SAM

A SAM reflects the socio-economic structure of an economy in a comprehensive way. Therefore, first, the SAM structure (e.g. types of accounts, transactions, aggregations, classifications, etc.) must be carefully designed and the data carefully selected and processed. The next step in the construction of a SAM is the creation of a consistent and balanced data set (see the sub-chapter on data requirements). Hence it is important to include the correct level of disaggregation for each account (e.g. construction divided into rural, provincial and national roads, irrigation schemes, water supplies, etc.) necessary for future analysis. The move from a SAM data framework to a SAM model or multiplier framework requires the adoption of a number of assumptions, among others, being the specification of the SAM accounts as “exogenous” and “endogenous”. Endogenous accounts or variables are those explained by the economic system and interactions therein, while exogenous variables are determined outside of the economic system, e.g. a financial crisis, a natural disaster or are policy-determined, e.g. public spending, social policies, a free trade agreement. Endogenous accounts are, in general: commodities, activities, factors of production, enterprises and households. Exogenous are, in general: the government, the capital account and the rest of the world. Mostly, accounts intended to be used as policy instruments are made exogenous. The SAM framework allows flexibility in the determination of exogenous and endogenous accounts. Some government activities, for example, such as taxation could be made endogenous to assess the impact of taxation on employment and income distribution.

Figure 4. Principal circular “closed” economic flow[22]



For any given injection into the exogenous accounts of the SAM, the impact is transmitted among the endogenous accounts through the interdependent SAM system. The interwoven nature of the system implies that the incomes of factors, institutions and production are all derived from exogenous injections into the economy via a multiplier process. The multiplier process is developed on the assumption that when an endogenous income account receives an exogenous expenditure injection (e.g., a public infrastructure investment), it spends it in the same proportions as shown in the matrix of average propensities to spend (APS)[23].

[22] See Pyatt, Thorbecke (1976).
[23] The elements of the APS matrix are calculated by dividing each cell by its corresponding column sum total and are referred to as direct effects.

Table 6. Standard endogenous and exogenous accounts of a SAM[24]

			CURRENT ACCOUNT							Capital account	
			ENDOGENOUS					EXOGENOUS			
			Activities	Commodities	Production Factors	Households	Corporate	Government	Rest of world	Capital	Total Incomings
CURRENT ACCOUNT	ENDOGENOUS	Activities		Domestic output							Total Acitvity Demand Producer's Price
CURRENT ACCOUNT	ENDOGENOUS	Commodities	Intermediate demand			Household Comsumption	Corporate consumption	Government consumption	Exports	Gross capital formation	Total Commodity Demand Producer's Price
CURRENT ACCOUNT	ENDOGENOUS	Production Factors	Value added, factor cost						Factor income from abroad		Income dom. Production factor
CURRENT ACCOUNT	ENDOGENOUS	Households			Factor Labour income, Distrubuted Profits	Current transfers HH-HH	Health Payments, Retirement Pensions, etc.	Household subsidy/social transfer	Non factor income from abraod (remittances)		Disposable income HH
CURRENT ACCOUNT	ENDOGENOUS	Corporate Fin\Non Fin-Private/Public			Operating surplus-Non Distributed Profits	Insurance Premiums, Pension Funds, Health Insurance, etc.	Transfers corp-corp	Corporate subsidy, Transfer to Public Enterprises	Non factor income from abraod (profit repatr.)		Disposable income corp.
CURRENT ACCOUNT	Exogenous	Government	Net indirect taxes	Import duties, VAT minus Subsidy		Direct taxes, Social Security, Pension & Other transfers	Corporate tax, Public Enterprises Transfers	Gov Budget, Transfers Central to Local	Aid, Grants, NGO Transfers		Disposable income gov.
CURRENT ACCOUNT	Exogenous	Rest of World		Imports of goods and services	Factor income to abroad, Profit Remitance	Non Factor income to ROW	Non factor income to ROW	Interest payments, Embassy Payments		Financial Transactions-Reserves	Total foreign exchange paym.
Capital acc.	Exogenous	Consolidated Capital		Imports of capital goods		Households savings	Corporate Savings	Gov. Surplus/Deficit	Foreign savings/Foreing Trade Deficit		Total savings
		Total Outgoings	Gross Value of Output	Total Supply	Outlays of domestic factor inputs	Outlays of households	Outlays of Corporate	Outlays of Government	Total foreign exchange receipts	Total investments	

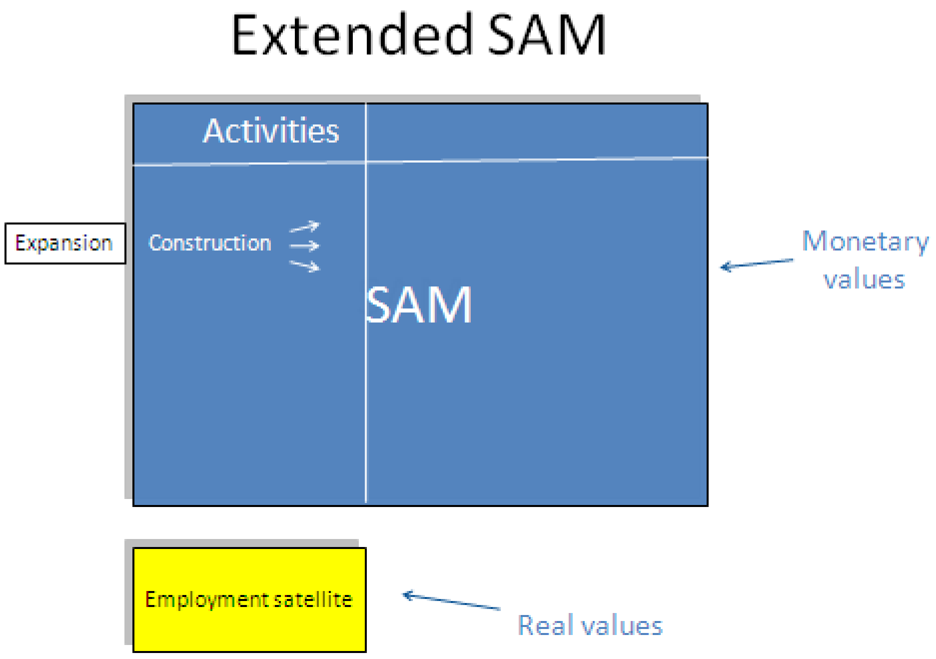
While modelling a SAM, satellite accounts can be used to introduce a wider range of analysis. This enlargement of a SAM is called "extension."

"Expansion" refers to using information to "blow out" existing entries within the SAM. For instance, the original SAM household and labour factor classifications can be increased or altered, e.g. by income or skill level. Similarly, the construction sector can be separated into various types of activities and/or commodities (i.e. infrastructure: roads, irrigation and water supplies).

"Extension" refers to the creation of satellite accounts with directly linked physical information. Examples of satellite accounts are those on employment, environmental aspects (Co2 emissions, land use), types of housing, or demographic information (e.g. total population disaggregated by age groups, rural/urban).

[24] Exogenous variables are those where one introduces changes for simulation, e.g. additional infrastructure investment by the government. Endogenous variables are determined within a model and will thus vary (e.g. production activities) as a result of the introduced change of an exogenous variable, in this case infrastructure investment.

Figure 5. Extended and expanded SAM



The conceptual framework of a SAM allows one to determine the potential impacts of different possible policy instruments. These can be controlled, in order to move the system in the directions of growth and equity that are consistent with the preferences of the policymakers. In this way, it enables policy makers to select certain activities and households for demand-driven intervention with the twin or single goals of achieving higher growth and/or greater equity.

As far as the degree of disaggregation is concerned, the SAM framework is flexible in allowing, in principle, any level of disaggregation, including technology choices. As the SAM encompasses all major stages of the economic process, it has a high analytical potential. The SAM multiplier analysis builds a greater understanding of the value chain, meaning the interdependent linkages (forward and backward) between the various sectors, and the institutional agents at work within the economy, namely households, enterprises and the government as well as with the rest of the world.

5.3 Type and level of analysis

The SAM can be used to support and strengthen the process of developing coherent national strategies by, *inter alia*, analysing the effects of investments and public policies on the economy. It can be used to specifically explore the relationship between public (infrastructure) investment (disaggregated by different technologies used to implement these investments, such as labour-intensive, capital-intensive or mixed methods) and (social) spending, job creation, income distribution and poverty reduction.

The SAM may be used for:

(i) Counterfactual simulation analysis with regard to the year for which it is computed. This helps to evaluate already implemented public investment and other employment-focused policies and validate ex-post experiences with policy value.

(ii) Short-run policy simulations (ex-ante) for future public policies and programmes. A comparison of various scenarios allows the selection of the most effective one in terms of cost, target groups and policy goals such as poverty reduction.

As with other economic data systems such as national accounts and input-output tables (Alarcon, J., et. al, 1991, p. 2), it can operate at the macro, meso and micro levels as well as the economic and social sides of the economy, and analyse their interactions. At the macro level, it can analyse the fiscal space, budgeting process, public investment and tax collection. It can then show how an injection, e.g. a public investment, influences the different sectors of the economy (meso) through the commodities and activities accounts. Details on factors of production (types of labour, qualification, rural/urban) and institutions (e.g. household groups, disaggregated by income, rural/urban, qualification), as well as an employment satellite account with detailed labour market information, can then demonstrate the impact of public policies at the micro level. An advantage of a SAM analysis is that it links the different levels and thus allows an analysis to be made in an integrated way.

5.4 Practical applications

A SAM is most appropriate for simulations of planned large, national public investments, comparing various future scenarios and options, but also to evaluate the impact of these investments in the past by counterfactual simulations[25] (comparison of a business-as-usual scenario with the scenario including the intervention). Moreover, policies can be analysed at the macro level, e.g. issues such as fiscal policies, national budgeting, public investment or social spending; at the meso level, e.g. trade (incl. production chain) and sectoral policies (agriculture, infrastructure); or at the micro level, e.g. their impact according to household or workers' groups.

The most interesting aspects of a SAM are, however, the links and transmission channels between these levels, for example how public policies affect various sectors and activities and, through this, households and workers. The introduction of satellite accounts opens up opportunities for a wide range of other useful analysis, for instance on climate change, green jobs and social protection. A SAM is also helpful in targeting policies towards a specific group of people, such as job opportunities for workers by income/wage groups or for unskilled female urban workers. Briefly, a SAM allows the comparison of policy options or the policy mix of two or more parallel policies using, as a selection criteria, their comparative impact on target groups, especially particular types of workers or households, targets (e.g. poverty reduction, job creation) or their cost-effectiveness, including their secondary effects (e.g. on GDP or tax collection).

So far, the SAM has proved less appropriate for the impact analysis of smaller, local or regional, investment projects, as well as for their monitoring and evaluation in general. Nevertheless, some recent initiatives, mostly in Asia, have been aimed at developing provincial and local SAMs. It is also less helpful in circumstances in which behavioural changes play a key role (behavioural assumptions can be added, but are not integral part of the method) or where price fluctuation is extremely strong, e.g., in case of hyperinflation. A static SAM does not include price changes.

The following examples will illustrate some of the possible applications of a static SAM:

[25] In others words two scenarios are compared: a) what has happened as a result of, or b) what would have happened without, the intervention. The final result is a minus b.

Use of SAMs to analyse the employment impact of economic sectors: case of Brazil

In **Brazil**, a study was conducted by J.B.S. Ferreira Filho (forthcoming)[26] using a static SAM developed in 2004 to analyse the employment dimension of the sugar cane sub-sector within the agricultural and agro-business sector, which had been experiencing technological changes and which is an important source of bio-fuel. This SAM[27] addresses labour as an input into sugar production, including details on income level of workers. The SAM has been expanded with disaggregation of the sugar cane sector at two levels: at the primary product level (1) the sector is disaggregated into (a) high technology and (b) low technology sugar cane production, and at the processing or industrial level (2), the end product is disaggregated into either ethanol (a) or sugar (b).

The results can be summarized as follows:

- Low technology sugar cane which is more labour-intensive, particularly with respect to unskilled workers, paradoxically is responsible for a relatively low share of the wage bill of this sector in Brazil, at 24.7 per cent compared with 75.3 per cent for high technology sugar cane.[28]
- The ethanol sector is more intensive in qualified labour than the sugar production sector. However, both processing sectors (2a and b) pay higher wages and recruit better qualified workers than the primary product sector for sugar cane (for both 1a – high - and 1b - low - technologies).
- With regard to processing, ethanol, which is supposed to be the subject of increasing world-wide demand, is more intensive in the use of higher qualified workers than the sugar production industry, which will, therefore, contribute to a further reduction in the demand for less qualified workers. The whole sector would thus become less promising for absorbing low skilled workers in the future.

Use of SAMs to simulate gender impacts of a public employment programme: case of South Africa

Another study, by the Levy Economics Institute of Bard College (Antonopoulos, 2009), uses a static gender-disaggregated SAM with time-use satellite accounts to simulate the full-time employment impact of an injection of 9.2 billion Rand (about USD 1.3 billion) in the social sector component[29] of a public works programme in **South Africa**. The model allows the analysis of the use of male and female labour in paid work for several stratified household types.[30] The results can be summarized as follows:

- 571,000 new full-time social sector jobs would have been created, with 540,000 of these jobs being for unskilled workers from poor and ultra-poor households. An additional 201,000 indirect jobs would have been created through a) activities related to intermediate

[26] Another recent study by J.B.S. Ferreira Filho (forthcoming, b) analysed the employment situation in forestry in the Amazon region using a provincial SAM focusing on the primary sector and related (processing) activities.

[27]The labour factor is measured by the wage bill which is the level of wages times the number of workers.

[28] The result is even more significant given that low technology sugar cane is considerably more labour-intensive and thus employs more workers. As an employment satellite account was not constructed, precise figures on employment cannot be drawn from the model.

[29] The Programme focuses on three sectors: “infrastructure,” “social” and “environmental”. The study showed the usefulness of increasing the financial injection to the social sector because of the high employment outcome, in particular for female workers.

[30] Parallel satellite time-use accounts were designed to analyse the distribution of unpaid work for these household types.

inputs and b) higher consumption related to the higher incomes of the newly hired workers.

- 60 per cent of the jobs would have been taken by women: 317,000 by unskilled female workers and 16,000 by skilled women.
- This public spending would increase GDP growth by 1.8 per cent, and would lead to an additional (direct and indirect) tax collection of 3 billion Rand, lowering the total costs of the programme to R6.2 billion.
- Furthermore, the growth increase would be pro-poor, as the additional change in income for poor households is 5.6 per cent and for ultra-poor as high as 9.2 per cent, whereas for non-poor households, the increase is only 1.3 per cent.

Use of SAMs to analyse the impact of trade and FDI on employment: case of Costa Rica

The ILO has initiated other employment-related SAMs to analyse the impact of FDI and trade on employment. In the case of **Costa Rica,** a SAM was used to measure the linkages between the Export Processing Zones (EPZs) — which are dominated by offshoring activities — and other sectors of the economy. For this exercise, a SAM elaborated for Costa Rica by Sánchez (2006) was used, which includes 41 activities and 78 commodities.[31]

This model made it possible to determine the impact that an increase in production in one sector will have on the rest of the economy. Therefore, all the backward linkages caused by this production increase, i.e., aggregate demand effects and impacts on suppliers, amongst others, were measured.[32] The use of the SAM therefore provides a clear and comprehensive picture of the macroeconomic impact that outsourcing can have on the economy.

Table 7 below reflects the impact that an injection of one million Colones (about USD 2,000) into various sectors would have on the rest of the economy. As a result of the multiplier effect, an increase of one million Colones in the EPZs (Export Processing Zones) will create a total value of 4.4 million Colones in the whole economy. The exercise reveals the low linkages of both EPZs and IPRs (Inward Processing Regimes) when compared with other sectors. Both regimes are located only seventh and thirteenth out of the 33 manufacturing sectors included in this social accounting matrix (where a lower position means higher multiplier effects). Despite paying higher wages, the EPZs generate less than half of the employment effect generated by the coffee, canning or the processing and preserving of meat: this is because of their low linkages to the rest of the economy.

[31] Details of the methodology (including the calculation of employment multipliers) can be found in Ernst and Sanchez-Ancochea (2008).
[32] We ignore the analysis of forward linkages as they do not play an important role in the case of offshoring sectors.

Table 7. Un-weighted backward linkages, manufacturing sector, in Costa Rica, 2002

Ranking	Code	Item	Value
1	107	Reconstruction and repair of vehicles	2.65
2	93	Petroleum and basic chemical products	3.06
3	90	Leather products, including footwear	3.65
4	106	Machine and equipment	3.67
5	104	Basic metals	3.95
6	97	Pharmaceutical products and drugs	4.13
7	110	Export processing zone	4.38
8	92	Paper and paper products	4.97
9	100	Other chemical products	5.08
10	105	Metal products	5.16
11	94	Fertilizers and pesticides	5.36
12	89	Textile and clothing	5.48
13	109	Temporal admission (maquila)	5.51
14	86	Other food products	5.66
15	95	Synthetic resins and plastic materials	5.84
16	85	Cocoa, chocolate, etc.	6.10
17	91	Wood and wood products (including furniture)	6.25
…	…	…	…
27	80	Dairy products	8.04
28	87	Prepared animal feeds	8.04
29	77	Canning, processing and preserving of fish	8.22
30	79	Vegetable and animal oils and fats	8.25
31	82	Coffee gold	9.04
32	76	Canning, processing and preserving of meat	9.12
33	84	Sugar	9.17

Source: Own calculation, based on SAM developed by Sanchez (2006). Note: Value = Total (whole economy) backward linkage multiplier for each activity.

As an extension to the SAM, a simple satellite employment account was created.[33] The calculation of employment multipliers shows that the lack of linkages leads to limited employment effects. The value found for EPZ is low, at 0.34, which means an injection of one monetary unit will lead to a rise in employment by 0.34, and for IPR, by 0.52. The value of many other sectors is significantly higher: for example, coffee has a multiplier effect on employment of 5.5, public administration has 6.2 and “other food products” has 10.2.

The weak backward linkages are partly the result of the insufficient capabilities of domestic firms to provide the necessary inputs to the EPZ production process. Traditionally, Costa Rica has not been a producer of manufacturing inputs and domestic firms tend to be small and experience difficulties in meeting the required high quality standards and production levels (Gamboa et al., 2006). Special efforts are needed to create backward linkages within the country. Recent government initiatives have been working in this direction.

Measuring the employment impact of trade: the cases of India and South Africa

Another example for measuring the employment impact of trade comes from Kucera et al. (2010) who measured employment changes in **India** and **South Africa** as a result of trade contraction with the EU and US during the 2008-09 global crises. They used static SAMs with a more comprehensive employment satellite account. Their type I multiplier

[33] For the table, see Ernst and Sanchez-Ancochea (2008).

describes the intra-account effect, meaning the direct effects of an exogenous shock – in this case, trade contraction - on incomes and employment, as well as indirect effects through forward and backward linkages, as demonstrated above in the case of Costa Rica. Their type II multiplier addresses income-induced effects throughout the socio-economic circle. They look at two scenarios: Scenario A is limited to estimated jobs losses; Scenario B includes the job losses and the "jobs not created." The most important results can be summarized as follows:

- India and South Africa suffered from significant income and employment reduction as a consequence of the contraction of trade with the US and Europe. India: 3.9 million FTE jobs based on Scenario A and 10.1 million according to Scenario B for all industries. South Africa: 890,000 FTE jobs according to Scenario A and 960,000 according to Scenario B.
- Most of the decline was in the non-tradable sector as a result of the induced effect via income and consumption, which shows that the tradable and non-tradable sectors are linked and interdependent.
- In India, there is no gender bias of the employment contraction in the total figures, although a slightly higher share of less educated women, as compared with less educated men, have lost jobs. In South Africa, there is a general gender bias in favour of women since sectors dominated by women were less affected by the contraction. Nevertheless, once again, lower skilled women were more affected (47.6 per cent compared with 42.6 per cent for men).
- Regarding income inequality, trade decline had a lesser impact on lower income quintiles, thus contributing to lower income inequality in South Africa. In India, trade contraction did not have a significant impact on income distribution.

An inter-regional SAM: the case of Indonesia

An inter-regional SAM (IRSAM) has been developed to better understand the interactions between five major regions within Indonesia (Resosudarmo et al., 2008). This methodology has been further developed by Alarcon (2012) by adding an employment satellite account including additional dimensions of the quality of employment (composite indicators on vulnerable employment, precarious work, and informal employment).

The model undertaken by Alarcon and Ernst (forthcoming) provides a comparative analysis of the relationship between the level of the precarious work and that of economic development across different regions of Indonesia. Measuring the level of economic development by the annual average labour income, the range of variation in precarious work is the widest for the region (Kalimantan) with the highest average income. Although this region has the highest number of "decent work" (DW) sectors, the upper limit and overall composite indicator of precarious employment is also the highest. The regions with the next two highest incomes (Sumatra, and Java and Bali) show narrower ranges of precarious employment and lower upper limits. Sumatra has the largest number of DW sectors whereas Java & Bali has the lowest, the composite indicators second and third, in reverse order. The two lowest average income regions (East Indonesia and Sulawesi) have the narrowest ranges of and the lowest upper limit to precarious employment with two thirds of the sectors in each region showing "decent work" characteristics. Here the composite indices of precarious employment are the lowest.

The findings indicate greater disparities in labour vulnerability combined with larger pockets of labour vulnerability associated with higher labour income regions and vice versa, implying that income distribution is worse within high income regions. One possible explanation would be that that the highest income regions attract labour migration from the lower income regions, and migrants invariably land jobs with higher vulnerability.

Clearly the results seem to indicate that sectors with high capital intensity, whether manufacturing (machinery, chemicals) or extraction (mining) and more up-to-date technology (oil extraction and refining) are among those with higher decent work characteristics (lowest composite precarious employment indicators). Whereas, on the whole, most service (trade, hotels, restaurants), light manufacturing and agro-based (food processing, textiles) sectors fare poorly in terms of quality of employment. These results, which largely correspond with what one could expect about decent work sectors, beg the question about whether decent work policies can be effectively implemented in the face of economic characteristics which are viewed as deterministic (such as those related to capital intensity, advanced technology, production scale, large domestic and external markets, etc.).

In brief, Indonesian IRSAM model, with its main focus on regional development indicators, provides the following results:

- The degree of inter-dependence of regions is low, that is, regions are largely independent of each other's economic evolution and geographical proximity;
- Nevertheless:
    - The three least developed regions, Kalimantan, Sulawesi and East Indonesia, show some degree of economic interdependence;
    - The three least developed regions tend to be more economically dependent on the two richer regions;
    - The Java and Bali region derives comparatively more benefits, albeit small, as a result of the expansion of the three least developed regions and even the more developed Sumatra region;
- For all regions the economic activities with the highest impacts on both income levels and on decent work are those related to food production or consumption, especially for those with high population density and/or tourism;
- Next in line in terms of the importance of economic output for most regions are government services, restaurants and hotels, especially for those with high population density, disproportionate government representation and/or tourism;
- Those activities which contribute the least to output, for most regions, are transport services, an indication that inter-regional transport facilities are lagging behind;
- Impacts of the construction sector (including but not limited to labour intensive road building, capital intensive road building, irrigation), except for East Indonesia, seem rather similar across regions reflecting similar structural technology in use;
- The regions with rich resource endowments, whether natural or tourism-related, show clear economic advantage in relation to the resource poor regions, e.g. oil and refineries in Kalimantan and Sumatra.

5.5 Input Requirements

The major input required for a static SAM is reliable data. Besides the data issue, there is a need for skilled local staff, first of all, to construct a new SAM - or to up-date an existing SAM, and secondly to actually make use the SAM to carry out employment impact assessments or to model other economic outcomes. The skill requirements are obviously higher for a SAM than for an input-output model, as a result of the higher complexity of the model. However, software and hardware requirements for a static SAM are relatively low.[34]

[34] SAM analysis can be carried out on a standard spreadsheet platform.

5.6 Strengths, limitations and challenges of social accounting matrices

The major strengths of a static SAM framework are as follows:

- A SAM shows the full circular socio-economic flow (production → distribution → demand → production) of a nation.
- A SAM is useful not only for ex-post impact assessments but also forward-looking simulations of future potential scenarios.
- It serves as consistent and encompassing database for the real and the financial sides of the economy.
- Flow variables with different units (money metric SAM) can be related to stock variables (employment, education, population, land, depletion of resources).
- It is a comparatively robust model when used with reliable national accounts data.
- It helps to identify the quality and nature of existing information which comes from diverse sources, exposing the weaknesses of and revealing problems with existing data (e.g. sample and coverage).
- It shows the interactions between different levels of the economy: macro, meso and micro. Each level can be analysed separately, although the model's main advantage is that it allows the interdependences and interactions between these levels to be analysed.
- An employment satellite account can be added to a SAM with details of the labour market, as well as multiplier effects thus improving the targeting of public policies (e.g. households, workers, enterprises).
- It includes technology choices: share of labour/capital use.
- It allows the derivation of average and marginal propensities to consume and income shares.
- SAM models use simple and straightforward multiplier methodology for short to medium-term policy making.
- Multipliers can be decomposed, e.g. transfer effects, intra-account and induced effects, forward, backward linkages.
- Socio-economic household characteristics facilitate the analysis of distribution.
- It helps to derive prices/indices for commodities, activities, GDP deflator and consumer price indices.
- It serves as the base for the development of a full-fledged Computable General Equilibrium model.
- As it is a tool which is transparent, not overly complex and easy to understand, it can be used by a large group of actors and is appropriate for inter-ministerial discussions and social dialogue on future policy directions.

The major weaknesses of a static SAM can be summarized as follows:

- Data requirements are high in terms of both quantity and quality.
- It remains a fixed price model, relying on income elasticities to reflect some level of economic behaviour.
- The multiplier is linear and not dynamic.
- It does not take into account behavioural assumptions.
- The internal rate of return and opportunity costs are not analysed within the model.
- No supply side constraints are designed into the model. Therefore it is assumed that resources or factors of production are freely available.
- Even though it is not a highly sophisticate model, it does need people who are trained in its use.
- Technical coefficients are assumed to be fixed.[35]

[35] ILO (2009).

- With regard to employment impacts of infrastructure development, it is mainly appropriate for large national investment programmes.
- It is not appropriate for monitoring projects.
- Generally, SAMs describe a closed system.
- SAMs require some strong assumptions which may not always be realistic (e.g. homogenous commodities, shares of industries constant over a certain period, constant returns to scale).

What are the major challenges countries may face in the implementation of a SAM tool for analysis?

The setting-up of a SAM modelling process can be difficult, as the development of a SAM can be time consuming, local staff must be involved and trained in the methodology and the decision-makers have to be convinced about the usefulness of the method. Once these steps have been taken with success and a critical mass of SAM experts has been created, the following steps become much easier. The additional costs and time for using the model are much more limited.

Another possible hurdle is the quantity and quality of the data. If data are unreliable or missing and, therefore, have to be estimated—policy advice could go in the wrong direction and jeopardize the reputation of the entire model. Nevertheless, the construction of a SAM often helps to detect data inconsistencies and, therefore, provides a way to improve existing data. Additionally, the analytical quality of the model also depends on the assumptions taken: they should be discussed openly and transparently when rendering conclusions at the national context.

6 Dynamic social accounting matrices

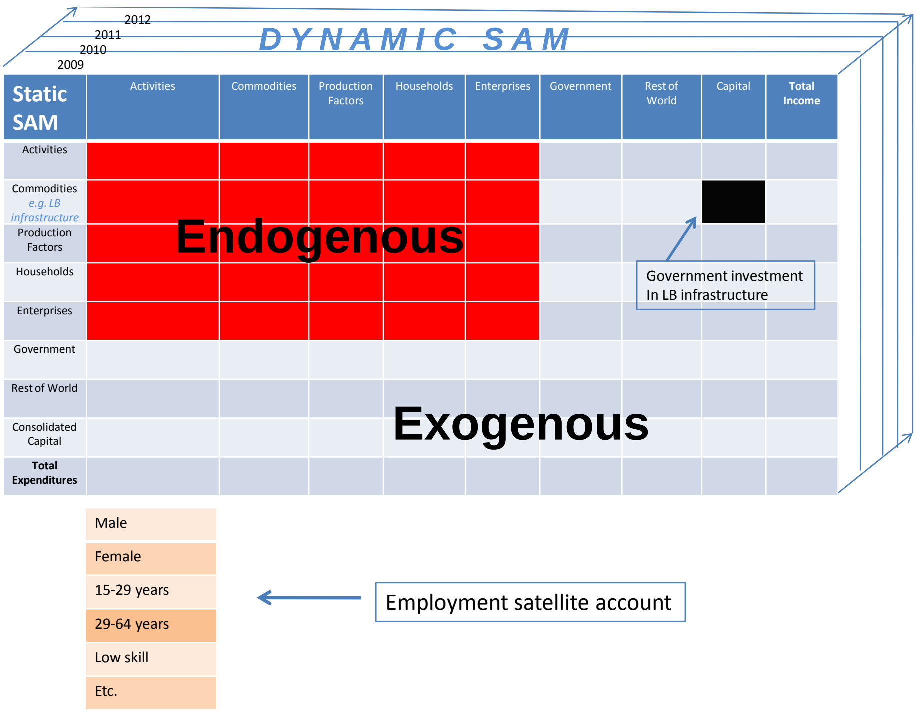
6.1 Theory

Definition and description of the model

As a static SAM covers only a single period of data, there was a need to develop a dynamic SAM (DySAM) with a time series of data (see Figure 6). More concretely, a DySAM should address the four main limitations of a static SAM: i) a SAM model is static with fixed coefficients; ii) data in the SAM refers to one single period (normally one year); iii) the year of the SAM is normally not current; and iv) a SAM does not take into account economic behaviour.

Figure 6 shows the additional third dimension, the time dimension, which distinguishes a DySAM from a static SAM. The other elements are the same between the two types of a SAM.

Figure 6. Comparison static SAM - DySAM



Comparisons between the 'traditional' static SAM modelling as described before and the DySAM modelling can be summarized as follows:

- A DySAM is based on an existing 'static' SAM for the economy of a country and the available data from national accounts.
- The static SAM gives a snapshot of the economy, while a DySAM shows the consistent evolution of the economic structure over time, for periods covering the years before and after the static SAM.
- Several sequential SAMs over time introduce dynamics into the SAM analysis.
- Over time, shifts in technical coefficients such as labour productivity can reflect different technology choices.

- A DySAM lessens the need to calculate expenditure income elasticities in order to introduce behaviour.
- There will always be one DySAM period that matches surveys (e.g. labour, household expenditure, population), which eliminates the need to introduce time-bound assumptions.
- An employment satellite account for one or several years with disaggregated labour market data can be added and coupled with the DySAM, and matched with exact year of the particular survey.
- A DySAM facilitates the use of place holders when information is scarce, missing or not fully reliable.
- The DySAM can be updated when new data become available or when a more current System of National Accounts (SNA) time series data comes on-stream.

The DySAM is dynamic in the sense that it considers changes over time and it also provides some distinction on technology choices (e.g. on infrastructure). The structure of the past does not necessarily reflect the future; indeed, a major point in the analyses is to simulate different methods of sector delivery. For example, some may wish to use advanced, labour-based methods for construction, without compromising on quality or promoting activities that are highly labour-intensive by nature such as social services.

The DySAM multiplier analysis contributes to a greater understanding of the dynamic-interdependent linkages (forward, backward) between the different sectors and the institutional agents at work within the economy.

Construction of the model

Building a dynamic SAM entails the following elements: i) re-verifying the existing static SAM; ii) constructing a time series of macro control totals[36]; iii) constructing the dynamic sectoral SAM (DySAM); and iv) computing the sequence of multipliers (forward/backward/decompositions).

Once the derivation procedure of a dynamic macro SAM and adjustments for the SAM have been undertaken, the existing static SAM is transformed into a dynamic SAM by linking the static disaggregated SAM to a dynamic macro-meso control framework, the “DySAM Data Module”. The DySAM Data Module is specially designed to generate the macro-meso controls for the static SAM. The control flows are incorporated into the static SAM as it becomes dynamic and moves forward in time.

Satellite accounts can be coupled to a DySAM model to introduce a wider range of analysis as is done with static SAMs. The only difference is that the data complexity increases. On the other hand, the use of specific software for dynamic modelling (e.g. Vensim) facilitates the use and up-dating of modules such as the satellite accounts. Vensim facilitates also the use for analysis, but it also implies a basic knowledge in the use of the software. The DySAM multiplier analysis facilitates a better understanding of the dynamic-interdependent linkages between the different sectors of the economy and the institutional agents.

6.2 Type and level of analysis

The DySAM may be used for: (i) counterfactual simulation analysis at any year within the period for which it is computed, which helps to evaluate past experiences; and (ii) short-

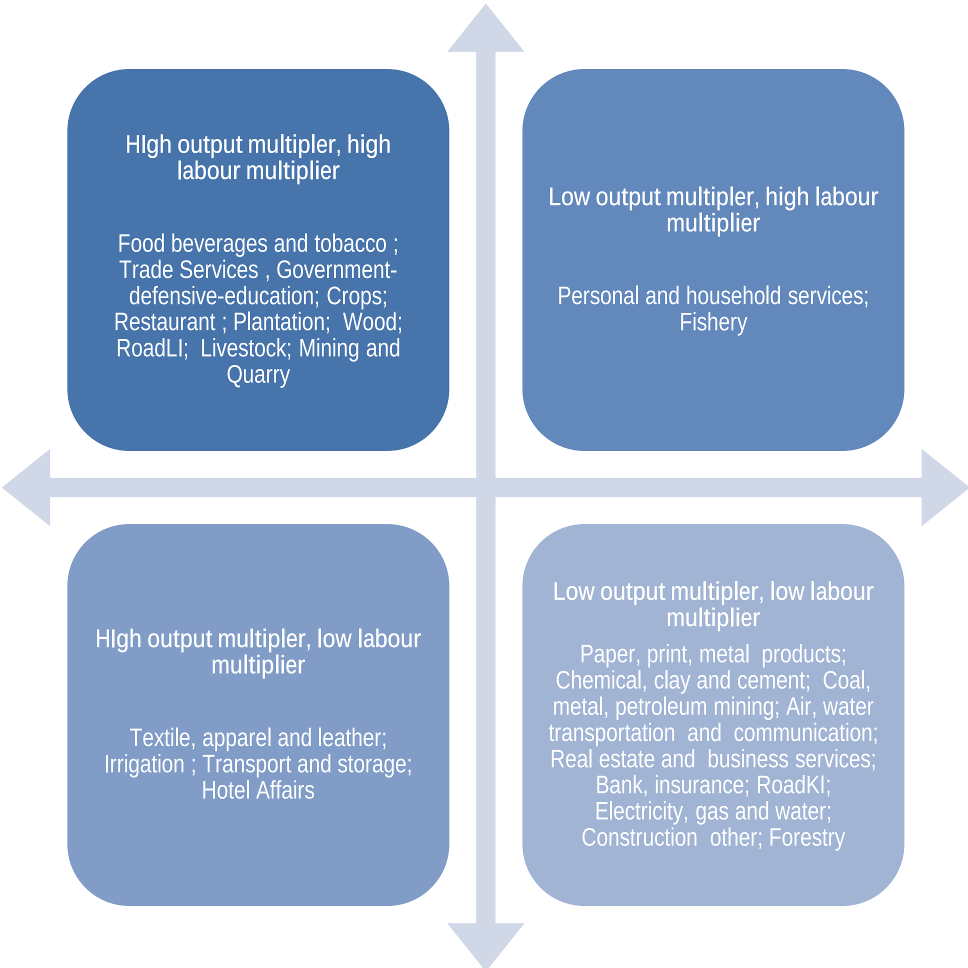
[36] In some countries (e.g. South Africa), there is a National Accounting Matrix already available, which can be directly used if it is (normally) compatible with existing SAM structure

run policy simulations from the terminal year and afterwards. Using the DySAM approach may be viewed as a "full-information" data model, which mitigates the exclusive use of a dated static SAM or a SNA, the latter typically not having the degree of resolution needed to capture the circular flow operating in the economy. The value added of a DySAM is the time dimension of the analysis and the inclusion of behaviours, a step towards simple economic modelling. It allows dynamic analysis, time-series analysis and it may enlarge the time horizon of the analysis to a longer term.

6.3 Applications

A DySAM is a helpful analytical tool for carrying out simulations for future public policies, spending decisions or potential exogenous shocks targeted towards specific groups of people. However, it is also possible to evaluate the impact and effectiveness of public investments and programmes implemented in the past. The easy use of satellite accounts allows the inclusion of new aspects of analysis, e.g. on climate change, green jobs, further details on social protection, etc.

Figure 7. Matrix of labour and output multipliers by sector for Indonesia, 2008



Source: Hartono, 2010.

Both static and dynamic SAMs provide less appropriate tools for the impact analysis of smaller, local or regional investment projects. Behaviours can be included in the model only to a limited extent; there are, therefore, more convenient models, when behavioural changes are important. Where there is strong price fluctuation, a DySAM model may also not be the most appropriate tool.

A DySAM helps understand the characteristics of each sector of the economy in relation to its economic growth and employment creation potentials. Some sectors are not labour intensive, but have high rates of growth. Other sectors may be important employment providers, but contribute less to national output. If the objective of policy is to promote job-rich and inclusive growth, this information is important. Based on the **Indonesian** DySAM, (Alarcón et al., 2011), one can cluster the sectors into four groups according to their labour and output multiplier index as in the Figure 7 above.[37]

A DySAM created in **Mozambique** analysed the growth potential for different economic sectors and distinguished between impacts being felt within the sector where investment is being undertaken, and impacts being felt in other sectors due to induced effects resulting from the injection of workers' salaries into the wider economy.

All of the eight top ranking (in terms of highest overall growth potential resulting from investment) commodities are from agriculture ("Other Grain," "Rice," "Cassava," "Cotton," "Cashew," "Bean," "Livestock" and "Maize"). It appears that the high growth potential of several of the top ranked commodities is the result of workers in those sectors spending their salaries and thereby boosting household consumption of goods and services. Hence, stimulating their demand has the potential for generating the highest economic growth.

With the exception of the lowest two commodity groups, the induced effects are consistently larger than the intra-account transfer impacts. For the top 11 commodity groups the induced impact is over 2.5 times the intra-account impact. This indicates that higher contributions to total impacts are transmitted mainly via the accounts that do not receive the initial injection.

One of the main aims of the DySAM is to assess the employment impact of public policies and spending, of infrastructure investments in general, and of labour intensive *versus* capital intensive road construction, in particular. The following example is taken from a DySAM that estimates the employment impact of the infrastructure component of the 2008/9 fiscal stimulus package in **Indonesia**. This DySAM was built in 2008 based on a static SAM built in 2005 for the Indonesian economy (Alarcon et al., 2011). The investments which were analysed include the rehabilitation of roads, airports, seaports, railways, housing, traditional markets, rice warehouses and the strengthening of training institutions. The simulation is based on an injection of Indonesian Rupiahs (IDR) 10.8 trillion infrastructure spending which is based on a realisation rate of 89% of the total budgeted stimulus spending for that year.

Of the 10.815 IDR trillion to construction, also called the Fiscal Stimulus Package Construction (FSPC), the GOI allocated 10.665 trillion rupiahs directly to infrastructure works and 150 billion rupiahs to build public school and public health facilities, e.g. facilities directly undertaken by the government in 2008,. Considering that the volume of capital formation in construction was, on average over the 2000-2008 period, about IDR 416,549.23 billion, the executed/injection amount represented 3 per cent of the capital formation.

The main purpose of the scenario is to calculate the different impacts of the FSPC on the economy, including commodity, activity, labour factor, institutional account as well as job creation using the Indonesia DySAM model.

[37] Note that this schema represents the economic flows of all input-ouput models, and is not specific to a DySam.

Table 8. Economy-wide Impacts of FSPC Injection of 10,665.0 billion rupiahs in 2009 (billion rupiahs)

Impacted Accounts	A: Forecast 2009 + injection	B: Forecast 2009 Base	Injection Effect (A-B)	Growth Effect
Commodity Output	10,117,070.7	10,086,525.3	30,545.4	0.303%
Activity Output	9,717,032.2	9,687,837.2	29,195.0	0.301%
Factor Income Value Added or GDP (factor cost)	4,904,091.1	4,890,629.3	13,461.8	0.275%
Institution Income	5,663,943.4	5,649,536.3	14,407.1	0.255%
Government Income	860,800.03	858,511.45	2,288.58	0.27%

Source: DySAM Output and own calculations.

The impact of the FSPC programme on each of the main four accounts can be found in Table 8, where in column (A) the forecast for 2009 plus the impact of the injection is presented, while in column (B) the forecast for 2009 is shown without the injection. The difference between the two is the net injection impact, these values by main account are presented in column (A-B), and the FSPC impacts vary from 14,407 billion IDR for institutional incomes to 30,545 billion IDR for commodity output. The total effect of the FSPC is close to 2.3 trillion rupiahs for the government budget.

In terms of growth, the impact on production (commodity and activity output) translates into growth rates slightly over 0.3 per cent. In contrast, income generation growth reaches 0.27 per cent for factor income (GDP at factor cost in table 16) and 0.255 per cent for institution income, (see table 8, last column). Put into perspective, the 10.8 trillion IDRs amounts to 0.15 of GDP and generates 0.27 per cent GDP growth.

Since the government receives income back via taxes, calculated at about 2.3 trillion, the net cost to the government amounts to 8.6 trillion rupiahs (see Table 9).

Table 9. Net Cost of the Construction Fiscal Stimulus Package in 2009 (billions of rupiahs)

Injection Fiscal Stimulus Package	Effect on Government Income	Net Cost Fiscal Stimulus Package
10,815.00	2,288.58	8,526.42

In terms of the impact on employment, the almost 11 trillion rupiahs FSPC via construction generate 287,000 thousand jobs (see Table 10). Looking at construction by type, 9 per cent of these jobs are generated in road labour intensive building and only 1.7 per cent in irrigation.

It is interesting to see that the job creation impact on the largest economic activity, namely Crops, stands to create close to 90 thousand jobs or 28.5 per cent of all the additional employment, which is much higher than its share in overall employment (19.6%).

Table 10. Total Impact on Job creation 2009: Economy Wide, Construction by Type and Crops

JOB CREATION by activities	Employment Increase (Growth)	Share	FTE Factor (*)	FTE Persons (*)	FTE Share
Total Economy Wide	287,060 (0.26%)	100%	1.02	292,801	100.0%
Road Labour Intensive	25,722 (9%)	9.0%	1.16	29,791	10.2%
Road Capital Intensive	8,539 (9%)	3.0%	1.16	9,890	3.4%
Irrigation	4,851 (9%)	1.7%	1.16	5,619	1.9%
Construction Rest	11,125 (9%)	3.9%	1.16	12,884	4.4%
Crops	81,951 (0.22)	28.5%	0.80	65,204	22.3%

(*) **Source:** Total Manpower, Full Time Equivalence (FTE) and Average Work Hours Per Week, by Business Classification: BPS SAM Indonesia, 2005.

The results need to be corrected for over- or underemployment, using the provided data, which have been derived from Full-Time Equivalence (FTE) factors of the 2005 SAM. For the entire labour force, the factor is 1.02, thus the actual employment level is close to 293,000 labour equivalent places. For Construction, the FTE factor is 1.16, one of the highest among all reported economic activities. The employment equivalent shares are now considerably higher for construction activities but lower for crops activities by as much as 6.2 percentage points (FTE factor is 0.80), an activity with high underemployment. Labour-intensive road construction now creates 29,800 full-time jobs instead of 25,700 jobs without correction for FTE.[38]

It is also interesting to use the DySAM to analyse who gets the jobs. Most youth employment gains will take place in the targeted sectors and within those activities considered as youth promoting activities. The economy-wide gains are 110,502 job opportunities for young people out of the total increase of 388,615 (or 28.4%).

Looking at the targeted activities, the shares of youth employment vary between 29 per cent and almost 41 per cent. Youth employment will grow faster if labour-intensive road construction is prioritized, which is followed by crops, trade and other construction. The other most beneficial sectors for youth employment promotion are mainly service activities (ILO, 2011). Overall one can say that sectors which are good for job creation in general, are even better for youth employment. Therefore there are little trade-offs between youth employment and policies to promote employment for the population at large.

Most of the job creation will take place in rural areas (59 per cent) and jobs will be created primarily for men (62.3 per cent). The figures for the construction sector show a lower share of urban workers (48.4 per cent) when compared with the total economy, and a very strong domination of male workers with over 97.6 per cent of the jobs created going to men.

6.4 Input requirements

The major inputs required are once again the data. However, now even more is required in order to constitute a time-series. Besides the data requirements, there is a need for skilled local staff, firstly for up-dating and constructing a DySAM, and secondly for using it. The skill requirements are obviously slightly higher for a dynamic SAM than for a

[38] Other national studies came up with other figures, which can be explained by differences in assumptions when applying their models, mainly on: 1. Economic growth forecasts, 2. definition of a job, 3. definition of multipliers, 4. application of economic versus engineering methods of calculating multipliers, 5. time span.

static SAM. The same applies to the software: dynamic modelling requires more sophisticated software for data handling, manipulation, and multiplier calculation. However, once the multipliers are calculated, they can be extracted into standard spreadsheet software which can also handle simulating policy scenarios.

6.5 Strengths, limitations and challenges of dynamic social accounting matrices

A DySAM has the same strong points as mentioned above with respect to the static SAM. The major additional strengths of the DySAM are as follows:

- Dynamic SAMs enhance all the characteristics of the static version and, additionally, allow behavioural and technical changes to be understood over time. At the same time, it allows comparing different potential scenarios with the baseline and how all the interactions work across time.
- The DySAM is consistent over time and provides contemporaneous data on GDP.
- Captures and portrays the development characteristics and stylised facts of the country in question.
- DySAM with its enhanced modular approach allows the fast and easy integration (and subsequently, up-dating) of additional information (e.g. employment satellite account, environmental account on CO_2 emissions) and thus enables a wide range of applications.

A DySAM also shares the major weaknesses of a static SAM, although it does mitigate or help to resolve some of them. Because of its time dimension, the separate calculation of income elasticities is less necessary as a means of including household consumption behaviour. In addition, the technical coefficients are not fixed. Nevertheless, data requirements are higher as data for more than one point in time is needed. Related to this, skill requirements for people working on it are also slightly higher, as are software and hardware requirements. In brief, the costs for the setting-up of a DySAM are higher, although not necessarily its maintenance as a DySAM avoids setting-up a completely new SAM after a certain time period.

What are the challenges ahead? The construction of a DySAM is costly and time consuming. Local staff must be involved and trained in the methodology, and decision-makers have to be aware about its potential and long term use in order to evaluate policy impacts and involve the right people during the process of capacity building (public servants, technical staff, universities, etc.). Once the initial steps have been overcome, the followings become much easier. The additional costs and time for using the model are much more limited; even up-dating is not a major concern.

Another possible challenge will be the quantity and quality of the data. If the data are not good, the model could lead to incorrect policy advice as in every model or data analysis. In fact, the construction of a DySAM may help to detect data inconsistencies—also between years—and is, therefore, a way of improving existing data. The quality of the model also depends on the assumptions taken. The need to take some strong assumptions required with static models can be relaxed whereas new ones may have to be introduced (e.g. a labour demand function). All assumptions should be chosen with care, taking the national context into consideration.

7 Data requirements for employment impact assessments

7.1 Data requirements at project level

Before elaborating on data requirements for simulations with EmpIA tools, one must first ascertain what type of data is available. In the case of most projects which have a Management Information System, this process begins by looking at the data compiled in the MIS. In chapter 2, it was explained that a MIS not only performs the function of managing project data, but also enables the project management to monitor and evaluate the performance of individual project components and sub-components. Some of the data compiled in the MIS will also be of high value for EmpIA models.

In infrastructure projects implemented with a labour-based approach, the most common indicators used are:

Table 11. Indicators and their definitions

	Indicator	Definition
1	*Project Outputs.*	This specifies the project outputs and progress to date on these outputs (for example km of roads constructed, number of ha of irrigation fields rehabilitated as well as some indication of the technical standards and dimensions of this infrastructure)
2	*Person-days of Employment Created.*	The number of men and women who worked on a project x the number of days each person worked.
3	*Job Opportunities*[39] *Created.*	1 job opportunity = paid work for an individual created on a project for any period of time (disaggregated by sex).
4	*Amount paid to workers.*	This should be the total amount paid to workers on projects (disaggregated by sex).
5	*Training Person-Days (on applicable projects.)*	The number of Training Person- days is the number of people who attended training x the number of days of training (disaggregated by sex).
6	*Actual Project Expenditure*	Expenditure to date on the project, broken down by years and according to project outputs in order to arrive at unit costs for infrastructure.

In the framework of a PEP, implementing Ministries or agencies may also assess the performance of their own projects in regards to the overall project employment objectives. The table below provides a number of performance indicators which can be used by project managers to evaluate their own project performance against the national targets.

The data derived from a MIS related to the wage share per type of investment could be a useful input to run simulations using EmpIA tools.

In a large PEP such as MGNREGA[40], workers are obliged to provide the following information at the time of registration:

[39] One problem encountered in evaluating and comparing projects, is that an “employment” opportunity may be defined differently from one project to the next, ranging from a week or less to most of the year. Therefore to ensure comparability of data, it is important to also provide data on workdays created, which then can be converted to full time equivalents, or person-years of employment created.
[40] The Mahatma Gandhi National Rural Employment Guarantee Act.

- Name:
- Identification Number:
- Date of Birth:
- Gender:
- Disability: Y/N
- Cell phone Number:
- Address:
- Recipient of welfare/social grants (if applicable):
- Education level attained.

This not only provides essential information on participants for M&E purposes, but it furthermore baseline information for later impact assessment processes. These data can feed into employment satellite accounts and are essential to know the labour outcomes of investments per age cohort, gender and education/skills level.

Table 12. Performance indicators

	Performance Indicator	Calculation	Examples of Proposed Minimum Target
1	*Average number of days of work provided per beneficiary.*	Number of person-days/ number of work opportunities.	50 days
2	*Global percentage of project funding paid out in wages*	Project expenditure/ amount paid to wages.	60%
4	*Person-days per million US$ allocated.*	Person-days or work created/ project expenditure.	50,000
5	*Cost per average work opportunity.*	Total project costs/ number of work opportunities.	US$ 500

7.2 Specific technical data requirements for simulations using EmpIA tools

Level of inputs

The first question that arises in this sort of modelling exercise is how to characterize the policy impulse for the model to analyse. To assess the employment impact of an investment that intervenes in several sectors, we need to know how this will change spending – and consumption - levels overall and across industries. In the field of public investments in infrastructure, required inputs are the level and the industrial composition of investment flows resulting from a policy decision to increase infrastructure investments or to modify the way (e.g., the technology used) in which these are implemented. The same applies for a public employment programme that intervenes in several sectors: one needs to match up appropriated spending with the industrial classifications that are represented in the EmpIA model. Essentially, “scoring” an investment proposal using an EmpIA model requires making judgments both on how much spending is being called for and into which industries the spending flows (i.e., amounts and allocation of investment spending). In addition, infrastructure will have to be disaggregated into the specific sectors to which infrastructure spending is allocated, such as water, buildings, construction, etc.

Once investment levels in a certain sector, such as roads, are known, the next step will be to examine how much spending will be allocated to the construction and maintenance of highways, regional roads and rural roads as each major class of roads has its own labour/capital ratio. The final step is to analyse a sample of representative projects in order to develop a representative cost breakdown and to use these representative projects to specify the quantities and costs of the various inputs required and to match them to the existing or newly developed model structure.

These inputs are essential to calculate both the total number of direct and indirect jobs created by a given injection of infrastructure investment. First, one translates a given amount of infrastructure spending into the number of jobs directly created in the supplier industries. Second, one calculates how many jobs will be created in those industries that expand to supply goods and services to those industries directly receiving the investment flows. Such jobs are created through what is known as backward or upstream linkages, involving procurement undertaken by industries receiving investments. The construction industry purchases cement, steel, wood, equipment, etc. as well as less obvious supplies – such as services. These supplier industries would need to expand their production to support final output of the construction industry when it expands. Construction, as with almost all other kinds of production, requires a vast array of inputs.

Data collection and analysis

Data regarding investment levels are in principal available at government level (Ministry of Planning or sector Ministries in charge of implementation). Although obtaining such data appears to be straightforward, it is often much more complicated than expected[41] to find reliable information, this for the following reasons:

- Not all sector technical Ministries use a transparent and uniform system for allocating overhead costs (including staff, vehicles and other running costs) to individual projects, nor is a cost breakdown into standards components used in a EmpIA necessarily available, nor comparable to that used in other projects;
- Funding often becomes available late in the financial year resulting in partial implementation of projects, in other words there can be a substantial difference between planned and actual expenditures;
- In many countries, technical Ministries have delegated the implementation of projects to specialized Authorities or Agencies (such as Water Services Boards, Highway/Urban and Rural Road Authorities, Local Development Authorities, etc.). This means that critical information is no longer available at a central or Ministerial level, but rather needs to be collected at a lower or local level.

Considering the above challenges, there are in fact two ways to get the needed inputs for simulations using EmpIA tools: i) a desk study which will give a first indication of the investment level per sector and ii) consultations and collection of data at Ministerial/Agency level (or in the case of a project receiving technical support, from the executing agency, the consulting engineers or contractors) which will result in more reliable figures per sector and sub-sector.

For example, in 2008 the ILO undertook a desk study to investigate different options for Azerbaijan in using its oil revenues to fund employment-intensive infrastructure investments as part of a national employment strategy. Although Azerbaijan had experienced the fastest growth (>30%) in the world, it faced a persistent employment problem, hence the demand to outline a strategy to improve the demand for labour in non-oil sectors. The desk study consisted mainly of analysing the SPPRSD (State Program on Poverty Reduction and Sustainable Development – 2006-2015) and Project Appraisal Documents of several IFIs such as the World Bank and the Asian Development Bank which were co-funding projects with large infrastructure components. Data collected in this way

[41] See Annex 5 for an illustration of the difficulties encountered in undertaking a relatively straightforward cost comparison study of road projects in Cambodia.

helped to estimate available investment resources and to identify opportunities for re-channelling these investments for greater employment impact.

The second option, consultations and collection of data at sector (or sub-sector) level may be more cumbersome, but nevertheless is worthwhile since it will provide decision-makers with more reliable projections per sector and sub-sector.

In looking for investment data and project costing breakdowns, one should begin with those sectors with the greatest employment creation potential. These might be different from country to country as the infrastructure backlog and priorities vary. Consultations and investigations will be required at Ministries and Agencies in charge of:

- Road infrastructure (highways, urban and rural roads)
- Buildings (school infrastructure, public health infrastructure and communal/municipality infrastructure)
- Water supply and sanitation (urban water supply and drainage and village water supply)
- Irrigation schemes (large, medium and small-scale)
- Environmental protection/soil and water conservation

The final complementary option is to analyse per sector and sub-sector a representative sample of projects. Projects are disaggregated according to wages, materials, plant and equipment, tools and other costs. New MIS for projects should be developed to provide these data on a regular basis with inputs from the field structures in charge of project implementation. Otherwise, tenders and project data need to be analysed, and preferably complemented, with information provided by contractors. The ILO has undertaken such studies in many countries, including Cambodia, Egypt, Jordan, Kenya, Madagascar, Morocco, Senegal, Tunisia and Uganda, using experienced local engineers.

Such studies can be carried out at the level of sectors, or, for large scale projects having several components, on the basis of components. A good example is the gender disaggregated SAM application developed by the Levy Economics Institute of Bard College for the Expanded Public Works Programme (EPWP) in South Africa (Antonopoulos, 2008). The EPWP had three major components when the study was conducted in 2007, namely Infrastructure, Working for Water and the Social Sector. The SAM used by the Department of Agriculture was composed of 26 sectors, 7 exogenous sectors, 5 factors of production (capital, labour) disaggregated by skill and gender and 20 types of households. A sample of water projects was analysed using cash flow information on a water reticulation contract and on a tender submitted for a bulk water master plan. Social sector activities undertaken by the EPWP were matched into the SAM classification (health care, social care, domestic services, etc.). Simulations were undertaken to assess direct and indirect job creation, impact on GDP, pro-poor growth, tax-base expansion and poverty reduction.

In conclusion, the next table summarizes the data collection options available:

Table 13. Options available for data collection needed for simulations

	Available options	Average duration	Inputs
1	Desk study to find investment levels per sector	1 to 2 weeks	Senior specialist
2	Consultations and collection of data at Ministry/Agency level for several sectors/sub-sectors	2 months (depends on the number of key sectors to be covered)	Team composed of a senior specialist with 2 engineers
3	Detailed analysis of a representative sample of projects per sector and sub-sector	3 to 4 months (depending on number of key sectors to be covered)	Team composed of a senior specialist with 2 engineers having worked in different sectors

Obviously, the more detailed that the collected information is, the more reliable the predictions on labour market outcomes of investments will become. The option that will be selected will depend largely on the exact purpose of the EmpIA study and on the available time and funds.

7.3 Data requirements at the macro level

Data requirements at the macro level are quite different from those at the project level. The main sources of data - in particular, input-output tables, national accounts, budget and financial data, etc. - are found at the national level administered by the national statistics office, central banks or the ministry of finance. National surveys, such as household and labour force surveys, provide a main source of micro data and may be found at the national statistics office, the ministry of labour or its specialized agencies such as the national employment observatory. But as mentioned above (see sections 5.1 and 5.2), data and information gathered at the project level is often an important input for the macro models, in particular when the research hypothesis involves the introduction of different technology options and when models have to be disaggregated by sector and sub sector, as is the case for labour-based rural road construction.

First of all, the effectiveness of EmpIA methodologies depends on the quality, quantity and consistency of the data used. It is a shared condition for all methods, given that any serious policy decisions should be based on - however limited - empirical analysis. Secondly, it is unacceptable and self-defeating to shy away from dealing with a data problem because data does not improve by itself. The best approach is to start working with the existing data, in order to expose and address their weaknesses. Since data can refer to different periods, times series data needs to be checked for consistency with survey data: this is the best way to improve existing data quality and consistency. Hence, examining/testing the Input-Output/SAM based models and cross-checking it with other data sources (SNA, LFS) can provide good insights and thereby contribute to its improvement. In other words, this integration and cross-checking between different data sources helps to create consistency between survey data, financial flows and even physical data, such as employment or Co2 emissions. Finally, most developing countries already have I-O tables or SAMs, which means that there is a starting point upon which to build. The data complexity increases from an I/O table towards a DySAM, but also as a result of the comprehensiveness of the dataset being used.

An input-output model

As has been often repeated, the quality of a simulation's results depends on the quality of the data used to construct the model. In order to function properly, the input-output model requires a coherent accounting framework describing the economy of a given year, i.e. the input-output table. It also uses available data from the Table of Integrated Economic Accounts and the Table of Government Financial Operations. These two tables derive from the National Accounts and are the principal sources of information.

- **Input-output table.** This table summarizes most activities of an economy, including the transfers between the economic agents. For each product, it gives the origin (imported or local product) and the consequent use (intermediate consumption, final consumption, export, investment).
- **Table of Integrated Economic Accounts.** This table provides an overview of the accounts of an economy: current accounts, accumulation and wealth accounts. In a single table all the accounts of the institutional sectors, the complete economy and the rest of the world are displayed, as well as the balance of all the flows, credits and debits.
- **Table of Government Financial Operations.** This table describes all the financial operations carried out by the State.

Other required data which may be obtained from the National Accounts or from other sources concern:

- Employment productivity by sector of activity
- Statistics on foreign trade (by product, quantity, value, destination/origin, year, core imports)
- Nomenclature of activities and products
- Customs regulations and possibly the exchange matrix between the activities nomenclature and customs regulations.

To calculate cost structures, micro data and/or project details are required from completed investment projects, mainly on the different categories of expenditures during their construction, such as equipment, wages, materials, tools and other services. These data may often be obtained from the Ministry of Public Works or from the appropriate technical line ministry responsible for implementation.

SAM

A reliable database is paramount for the proper functioning of the model. Although consistency is a requirement for all modelling efforts, it does acquire added importance when deriving SAM multiplier sequences. In addition, the base year of the SAM structure, the number of accounts and the types of classifications will either limit or enrich the quality of analysis that may be envisaged. Another challenge is to obtain (or construct) data at an appropriate level of disaggregation for commodities or activities which will be the focus of further analysis.

More specifically, the following accounts are required to generate the macro data sets for any given economy:

- The real side (supply, production and demand);
- Government budget;
- Money and credit;
- Balance of payments;
- Population (households);
- Sectoral data on real and nominal GDP and employment; and
- Labour market data for the employment satellite account.

The numerical specifications of accounting frameworks (SNA, I-O, SAM) need to accurately represent the economy of a given country, and this depends on the availability of consistent and balanced data sets. Experience demonstrates that even when extensive data are available, barriers will exist because of inconsistencies and a failure to achieve a balance across different components of the data. It is, therefore, essential to assess the consistency features of a country’s data before embarking on the construction of a SAM.

DySAM

To ensure a well-functioning DySAM, a reliable but time consistent database is the key to success. Data requirements are higher for a DySAM as data is required for not just one year, but for a series of years. The creation of the subsequent SAMs required for building the DySAM, however, does not require the complete dataset as needed for the initial baseline static SAM for one specific year. It does however require at least a time-series of macro-meso control variables, mostly derived from national accounts data. Having said this, the DySAM is based on and therefore still needs a static SAM for the base year or the year of reference. Although consistency is a shared characteristic of all modelling efforts, additional care is needed when deriving dynamic SAM multiplier sequences. Furthermore, the base year SAM structure, the number of accounts, the types of classifications and the account openings will either limit or enrich the quality of analysis that may be envisaged. The dynamic Macro Social Accounting Matrix framework (macro-SAM) for a time series are derived using the information provided mainly by the SNA of a country with the same account specifications as for a static SAM, but with the time series of these data.

This derivation of consistent macro data sets should be conducted according to the following steps:

(iii) Data collection activities (if needed, include complement placeholder values - e.g. proxies for missing or erroneous values - from various sources).

(iv) Consistency assessment of the available data sets[42] (first iteration).

(v) Consistent data sets can be derived using the DySAM data module (second iteration).

[42] Relevant macroeconomic data need to be compiled in a *Macro Social Accounting Matrix framework (macro-SAM) and Flow-of-Funds framework (FoF)* in order to assess the intra- and inter-accounts consistency of the official data sets.

8 Conclusion

This Guide on tools for employment-impact assessment is based on the experience of the ILO's work in this field carried out jointly with national research institutes in developing, middle-income and industrialised countries. Its objective is both to show how a programme focusing on public investments in infrastructure can increase its employment content and to discover and extend the frontiers to new sources of job creation and its contribution to different workers' groups. Employment impact assessment provides a strategic means for achieving these objectives. While the focus of this review has been on methodologies applied in ILO supported projects in developing and emerging countries, the range of application and strategic potential is vast. Countries at all levels of development face the challenge of infrastructure deficits and high levels of unemployment and underemployment. Employment impact assessments can help to better harness and provide a policy impetus to increase the often underexploited potential of public investments for new job creation.

The Guide has provided a selection of various analytical tools and methods. First, it describes a variety of tools at the project level, which can help in facilitating, monitoring and evaluating direct employment creation at the micro level and in comparing labour-intensive projects with alternative technologies. Then, input-output or social accounting matrix based methods have been presented. These can support policy decisions at the macro level by evaluating the effectiveness of past investments, and – even more importantly – by simulating the potential impact of future policies. The complexity increases from an I-O table to a DySAM, but also the level of accuracy rises. These tools describe the direct, indirect and induced effects of infrastructure investment, and can disaggregate these effects on specific target groups of workers. These tools can also show differences in employment impacts as a result of technology choices. These methodologies are not limited to the analysis of infrastructure, but can also be applied to the analysis of many other public spending and policies (social protection, trade, sectoral policies in general). For example, a further employment impact which is not described in this review, are the dynamic capability impacts which investments have on involved workers, enterprises and other (government, community) institutions. Other tools (baseline and impact studies) are needed to assess the socio-economic impact of infrastructure investments and the longer term impacts which job creation can bring (income smoothing, reduction in vulnerability or poverty).

Also, simpler methods exist in case of lack of detailed data limitations. Tables showing the range of labour content (as part of total cost) of specified activities in different (sub-) sectors and tables showing multipliers for different settings can also be used as key tools for simulating employment effects. An alternative is to use Bills of Quantities prepared by contractors for tendering on infrastructure projects to calculate labour-days of inputs - and the underlying unit cost rates - to estimate direct short-term job creation. Actual expenditures, possibly combined with a field-based method of cross-checking the number of workdays created, provide another means for verifying or validating estimates or simulations. Finally some more complex tools, namely economic models such as CGEs have been used to analyse the socio-economic impact of infrastructure investment.

Presented models are also mostly static and based on an accounting system. The introduction of a dynamic social accounting matrix represents an attempt to overcome these limitations by integrating a time series analysis. As a result, labour coefficients and prices can change over time. Another possibility is to include simple economic modelling within the DySAM, such as a labour demand or a capital output function, which would enable the inclusion of some economic aspects (price change, private investment flows, trade), and increase the accuracy of the model without significantly increasing its complexity.

A major bottleneck of I-O/SAM models is that they focus mostly on the demand side. They show and simulate the employment demand and assume that labour supply is not a matter of constraint (mainly when the focus is on job creation). In fact, this mimics a potential weakness of employment intensive works programmes which stimulate demand for labour without prior assurances that the required labour is available. To some extent, supply side constraints could be detected through an analysis of the forward linkages. Otherwise, they could be calculated outside the model and be taken into consideration within the analysis.[43]

While SAMs are, to a certain extent, able to answer the question of who gets the jobs, specifying certain groups in the labour market who benefit from job creation (for example, based on ethnicity, level of income, degree of education, gender, etc.), further analysis beyond that which a SAM can deliver must be carried out in order to compare the tightness or slack of the labour market with respect to these groups. Recent models include data on informal employment, working hours and wages/income to capture also changes not just in formal, but also informal employment. If workers are in high demand, then job creation will be successful. However, if these groups benefit from low levels of unemployment, then creating additional job opportunities may result in displacing labour or longer working hours, rather than creating new employment opportunities.

Another challenge for the future consideration is to apply employment impact methodologies at the sub-national level, e.g., provincial or district levels. There are already cases such as SAMs based on local, or provincial I-O tables. The Mozambican DySAM already includes provincial information, divided into three areas: Maputo area, rural and urban. Also, a recent innovation in the Indonesian DySAM addresses provincial characteristics. Indonesia has started to produce some provincial SAMs (e.g. Java) and has created an inter-regional static SAM for 2005. Such regional or local analyses help channel employment policy into regions suffering from highest levels of un- and underemployment.

This study is not exhaustive and does not pretend to describe all currently available impact assessments. For example, the ILO has undertaken employment impact assessments of major stimulus packages in advanced economies, including an analysis of the American Recovery and Reconstruction Act (ARRA, the US stimulus package launched by the Obama Administration in 2009) (Zacharias, 2009; Miller, 2013) and collaboration with the European Investment Bank in rolling out the European Fund for Strategic Investment (the so-called Juncker Plan).

In evaluating the ARRA, the US Council of Economic Advisors used a variety of techniques in order to come up with estimates for the employment and economic impacts of the stimulus. For example, the employment impacts were measured based on a range of economic multipliers which had been developed previously by both government agencies and private sector forecasters. The multipliers varied according to the type of stimulus spending, which fell into three broad categories: tax relief, transfer payments and public investment spending (a large proportion of which fell into the infrastructure category). The projected growth brought about by the different categories of spending was then translated into job creation based on estimates of the employment intensity of economic growth. Other methods were used to corroborate these results. One method noted the degree of deviation of growth and employment which took place with respect to a statistical baseline estimate of the trajectory of the economy without the stimulus. Finally, direct recipient

[43] Another option for future methodological development would be an increasing inclusion of supply side considerations into employment impact assessment models, in particular labour supply. Such models should be able not only to estimate employment impacts, but furthermore show who will benefit from the additional jobs created.

reporting of jobs created, a requirement for those entities benefiting from public investment resources, was used as a third means of measuring employment impacts. (CEA, 2010).

Therefore there is a wide variety of techniques, economic models and approaches for undertaking employment impact assessments. Each one has strengths and limitations and faces specific methodological challenges. However, these limitations and methodological challenges are secondary to the political will required to institutionalize employment into public investment policy choices. It is hoped that this review will help give policy makers the tools required to transform political will into actual jobs.

Glossary

Backward linkage: A backward linkage is the impact which an exogenous injection can have (in terms of economic output, growth, employment) on suppliers which respond to the demand created for their goods and services. In terms of the economic models discussed in this guide (input-output tables or SAMs), an exogenous injection into an economic system increases the income of the corresponding accounts and then cascades onto the incomes of all other endogenous accounts. The sum of the impacts for each account receiving injections is represented as a column in an input-output table (or in a social accounting matrix) and constitutes the total partial linkage. For construction projects, materials, tools, plant and equipment will need either to be purchased or rented from other suppliers. The sum of all these effects represented as columns constitutes its total backward linkage.

Data module: A specially developed data set, where time series and SAM data are made consistent. The data module forms the basis of the DySAM.

Endogenous account: A set of economic variables that are determined within a model or that are the result of the modelling exercise. The set is therefore *not* subject to direct manipulation by the modeller since that would override the model. In SAM models, production (economic output) and incomes are almost always endogenous.

Endogenous variable: An economic variable that is part of the endogenous account. An endogenous variable is dependent, as opposed to an independent variable. It is therefore *not* subject to direct manipulation by the modeller since that would override the model. In trade models, the quantity of trade itself is almost always endogenous.

Exogenous account: A set of economic variables that are taken as given within an economic model. The set *is,* therefore, subject to direct manipulation by the modeller.

Exogenous variable: A variable that is part of an exogenous account. An exogenous variable is an independent, as opposed to a dependent, variable and in this guide often represents an injection of new and additional investment resources which is being modelled to determine its impact on growth and employment. An exogenous variable *is,* therefore, subject to direct manipulation by the modeller.

Force Account: Refers to workers hired directly as employees of the government or of a project rather than through a contractor. Force account can also refer to work ordered on a construction project without an existing agreement on its cost, and performed with the understanding that the contractor will bill the owner according to the cost of labour, materials, and equipment, plus a certain percentage for overhead and profit.

Forward linkage: Forward linkages represent the impact which exogenous injections can have on growth or employment as a result of the spending which newly employed workers (hired either directly or indirectly through supplying industries as a consequent of the additional resources injected into the economic system). In terms of the economic models discussed, these linkages are represented as rows which show the amounts of expenditures per account that are made 'available' for the expansion of other accounts. The results of these forward linkages can be interpreted as those additional resources which become available for markets, or simply as market potential. Forward linkages also include economic activities created downstream from the completed output (such as weighing stations created as a result of a road), but generally the upstream indirect employment created as a result are negligible in volume and do not figure in the input-output models.

Intermediate consumption (also called "intermediate expenditure") is an economic concept used in national accounts. Conceptually, the aggregate "intermediate consumption" is equal to the amount of the difference between Gross Output (roughly, the total sales value) and Net Output (gross value added or GDP). Thus, intermediate consumption is an accounting flow which consists of the total monetary value of goods and services *consumed or used up as inputs in production* by enterprises, including raw materials, services and various other operating expenses.

Intra-account effects: Intra-account effects measure impacts within the account where the injection enters. In DySAM modelling, intra-account effects (M1) are defined as the sum of the injection (I) and transfer (T) effects. They exist only for accounts with intra-account transactions.

Induced effects: Induced effects measure impacts outside the account where the injection enters, e.g. household expenditures, from the income earned in a directly or indirectly affected activity. In DySAM modelling, induced effects (OC) are defined as the sum of open loop (O) and closed loop (C) effects. They exist for all accounts.

Injections: Autonomous effects on exogenous accounts/variables. Examples of injections include an increase in investment expenditures, government purchases, and/or exports.

Leakages: Leakages are resources, initially part of the external injection, which escape having an impact on the endogenous variables being modelled. They are treated as exogenous expenditures accounts/variables in modelling exercises. For example, savings, taxes, remittances and imports are leakages whereby injected resources may not have their intended impact on growth or employment. In SAM modelling these transactions are defined as a B Matrix.

Macro control totals: Macro values are derived from an iterative process using the time series data to ensure consistency of values for a SAM. These values, derived over a given time period, are used to build and anchor a DySAM by applying a step-by-step iterative process.

Manpower equivalence: A conversion factor applied to the number of persons employed in order to reflect actual full-time equivalent working days.

Placeholder value: Proxy values used when “true” data is absent, scarce or inaccurate; the proxy values can be replaced once the “true” values are available.

Direct employment: Employment created directly by the construction project (or other economic activity) including senior staff, technicians, workers directly recruited by the main contractor and sub-contractors.

Indirect employment: Employment created in the backward-linked industries, supplying tools, materials, plant and equipment for the construction project.

Induced employment: Employment created as households benefitting from direct and indirect employment spend some of their additional income on goods and services in the economy. This employment is created through forward linkages.

Shock: An unexpected or unpredictable event that affects an economy, either positively or negatively. Technically, it refers to an unpredictable change in exogenous factors - that is, factors unexplained by economics - which may have an impact on endogenous economic variables.

Supply and use tables are used to balance the flows of goods and services in the economy and hence present a detailed analysis of the production and use of goods and services. The supply and use approach also provides the basis for checking the consistency of the measures of the supply and use of goods and services, which have been estimated from quite different statistical sources. This data confrontation results in balanced GDP and expenditure accounts. This approach leads to improvements in the accuracy of key national accounts measures, such as GDP, gross national expenditure, national disposable income, and their components. The accounts are balanced when, for all industries, total inputs equal total outputs and, for products, total supply equals total demand. Analytical tables produced for supply and use data confrontation are known as supply and use tables.

Technical coefficients reflect the *direct* effects of change in final demand for a certain commodity. In input-output analysis, technical coefficients identify the percentage or portion of the total inputs of a sector required to be purchased from another sector irrespective of the geographic origin of this purchase. Technical (input) coefficients represent direct backward linkages of an industry to other industries and constitute the "recipe" for production of that industry.

Note: The Glossary definitions are either those of the authors, or taken from or revised based on Deardorff's Glossary of International Economics (http://www-personal.umich.edu/~alandear/glossary/), from Wikepedia, from the Statistics New Zealand website, in the case of Supply and Use Tables (http://www.stats.govt.nz/browse_for_stats/economic_indicators/NationalAccounts/supply-use-tables-yr-end-mar-07.aspx) or from other sources cited in this Guide.

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Annex 1: Indicative list of employment-impact assessments carried out by the ILO and others

Africa

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Asia

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Annex 2: Duration of implementation and estimates in work months for employment impact assessment models

A. Input-output tables

The length of time needed to develop the model and the cost depend on various factors, in particular the quality of the available data, the capacity of the organisations responsible for data collection and the available skills for processing and analysing the data. An average time could be around 2.5 months, as follows:

- Data collection: This could be carried out in two weeks. It requires two specialists, one with local knowledge.
- Construction of the model and associated costs: The time taken may vary depending on the method of data storage. On average this involves one or two weeks of work.
- Development of the accounting framework (input/output) according to the model involves an average two or three weeks' work of two specialists.
- Final adjustment, simulations and validation of the model will require an additional three weeks' work by the lead specialist.

B. Static social accounting matrices

The time required to construct a SAM can vary between six weeks and six months depending on the availability of I-O tables and other relevant data, the quality of the data (the less inconsistency among the different data sources, the less time needed), the number of staff involved in implementation and the sequencing of activities. The costs may vary considerably depending on various factors such as the availability of a recent and "appropriate"[44] SAM, which then can be adjusted to reply to a specific policy question, the general quality of data, the need for manipulation and the available local capacities:

- **Data collection**: One half to one work month (w/m) senior consultant, two w/m junior consultant (assuming the availability supply use tables, input-output tables, and household and labour force surveys).[45]
- **Construction of a static SAM**. One half to two w/m senior consultant, one to three w/m junior consultant.

In general, the consultants will not work full-time on the construction of a SAM: there will be times when they are waiting for new data. A certain amount of time will also be set aside for checking the data and resolving inconsistencies. Generally, it would be helpful to have a relatively generous time frame for the construction since gathering and checking data always turns out to be a more time consuming exercise than expected.[46]

[44] "Appropriate" may mean with the right level of detail corresponding to the specific needs of the analysis, e.g. disaggregated construction sectors, household types by income decile, labour by rural/urban.
[45] A preliminary assignment to ensure that all requested data are available would speed up the process.
[46] An alternative to building a new SAM would be to use more recent survey data in combination with SNA data and iterative techniques, cross-entropy or econometric updating procedures. Costs and time would vary from two to four months depending on data availability and processing capacity.

- **Training:** between two days for decision makers, three (technicians) to five weeks (modellers)

  Training costs depend on how the training is organized. It could be in form of learning-by-doing, with the help of a senior consultant (one half w/m international consultant). A formal training programme for technicians from government ministries should last from one to three weeks but should also include an awareness-raising seminar for decision makers held over a maximum of two days (four work days, junior or senior consultant). The whole training process, including preparation and follow-up, then should involve three to five weeks for two to three national or international consultants, or a combination of the two.

- **Analysis:** One w/m national consultant(s) (depending on the amount and level of analysis required). Local staff (if not already SAM specialists) will be trained formally or through learning-by-doing and should be capable of carrying out simulations and analysis independently. Backstopping could be provided by a junior or senior trainer, if needed or requested (three work days of a national or international consultant).

C. Dynamic social accounting matrices

The (ideal) pre-condition for the construction a DySAM is that there is already a SAM to build on available in the country of analysis. The duration of the construction of a DySAM varies between twelve weeks and six months, depending on data issues, the number of staff involved in the implementation and the sequencing of activities. The costs may vary considerably depending on various factors such as the availability of a recent and "appropriate" SAM and of good quality data in general, as well as the need for manipulation and local capacities available:

- **Data scoping, collecting and verification**: 2 weeks (involvement of senior and junior consultants)
- **Data collection**: 1 w/m senior, 2 w/m junior consultant.[47]
- **Algorithm programming**: 4 to 6 weeks (normally done by 1 senior and 1 junior consultant)
- **Finalization of the SAM**. 2 w/m senior consultant, 1-3 w/m junior consultant.

In general, the consultants will not work full-time on the construction of a SAM; there will be times when they are waiting for new data, checking the data and resolving inconsistencies.

- **Training:** Two days for decision makers, one to three weeks for users and four to six weeks for modellers.

Training costs depend on the form in which the training is organized. It could be learning-by-doing with the help of a senior consultant (1/2 w/m senior/junior consultant), a formal training programme for modellers for 4 to 6 weeks and for technicians from government Ministries who will be using the model, from one to three weeks (three to five weeks of 2-3 consultants, national/international or a combination of the two), or a type of awareness-raising seminar for decision makers over a maximum of two days (four working days, national/international consultant).

[47] A preliminary assignment to ensure that all requested data are available would speed up the process.

- **Analysis:** 1 w/m (junior consultant(s) depending on the number of analyses). Local staff will be trained formally or through learning-by-doing and should be capable of doing their simulations and analysis independently. Backstopping could be provided by a local or international trainer, if needed or requested (three working days, national or international consultant). A software for dynamic modelling may be needed, which will cost between USD 500 and USD 1,000 for each license. Hardware must be reasonably recent.

Annex 3: Economic models and tools used to assess long-term economic, social and labour market impacts

This annex will provide an overview of additional, complementary models and tools which can be used to assess the longer-term impacts of infrastructure investments, beyond those focusing on implementation or operations and maintenance stages.

There are different impacts related to creation of new or improved infrastructure. These effects can be distinguished between economic or social impacts, which are inter-related and which therefore also affect the labour market. The economic effect will be explained by using the example of the construction of a paved road, which was previously unpaved. The construction of a paved road improves the connection, for example, between village A to the larger town B. The better connection will lead to shorter travel time and maybe also a reduction of transport costs. This improvement may therefore stimulate trade, affecting positively investment decisions and, as a result, productivity and production.

On the social side, the better road leads to improved access to administrative and health services and education and to larger markets improving, for example, food security and diversity. In particular, the positive economic effect, but also, to some extent, the positive social effect, may improve the labour market situation through more employment, improved jobs and better worker well-being.

These effects can be analysed mostly by two types of methods, economic models which includes a series of behavioural assumptions related to the above-mentioned issues on trade, investment, productivity and production, but also econometric models, mostly framed under a Cost-Benefit Analysis (CBA).

CBA is the most commonly used form of analysis in modern economics. Its applications are widespread, but in the context of development programs its goal is to properly identify and measure the cost and benefits of investments, in order to determine whether a project should be undertaken or not (Mishan and Quah, 2007). It is not always sufficient for the aggregate sum of costs and benefits to be above zero for a project to be approved or deemed feasible. The sum often has to be above a certain benchmark; or it has to exceed a given ratio, depending on the requirements of the party that is funding the investment. Cost effectiveness analysis is a form of CBA that has as a goal the determination of the least costly way of achieving a particular objective (Mishan and Quah, 2007).

The starting point of every CBA is assigning a market price to different variables. Since this does not take into account costs and benefits that are not included in the market, economists use different valuation methods such as the averted costs, human capital, or explicit and implicit valuation. The averted costs are the potential future costs that are avoided because of the improvements created through the investment. Other valuation methods that are commonly used in CBA are the discounted present value and the internal rate of return, together with sensitivity analysis (Williams, 2008). Shadow pricing can also be used to transform market prices which reflect actual scarcity or abundance of a particular input (such as labour, equipment or construction materials) into the production process

The Internal Rate of Return, also known as the Economic Rate of Return (ERR) or the discount rate in NPV calculation, is the interest rate that equates the net present value, or the present worth of a series of cash flows, to zero (Hartman and Schafrick, 2004, p.139). In other words, it is a form of the average rate of return that takes into account time (Mishan and Quah, 2007). It is used quite often as it is easy to compare it to the discounted rate of return, or the Minimum Attractive Rate of Return, in order to determine whether a project is feasible or not. To oversimplify the matter, calculating the Economic Rate of Return of a series of costs and benefits associated with a given investment project, allows policy makers to determine whether the project represents a good investment with respect to the alternative of simply putting the money in the bank earning interest at the going rate.

VAR is an econometric model more often used in financial analysis. It is "an n-equation, n-variable linear model" (Stock and Watson, 2001, p.1.) that presents the relationships between different variables in a concise and coherent way. VAR's simplicity in describing data and making predictions contributed to its widespread use since the 1980s. It is mainly used for a) forecasting economic time series (causality and structural[48] analysis), b) designing and evaluating economic models and c) evaluating the consequences of alternative policy actions.

Economic models provide an alternative to better understand the long term effects of a better infrastructure assuming a series of behaviours for the different economic markets in a specific country (or more globally). While partial equilibrium models limit their analysis to specific markets to be analysed (e.g. production), a (Computable) General Equilibrium is a set of equations that describe the economy, motivations and relationships between different actors in the economy (Burfisher, 2011) and aims at resolving equations on all economic markets simultaneously. Norén (2013) defines it as a series of maximisation problems pursued by the different actors. A general equilibrium model has a goal of solving all the maximisation problems simultaneously to arrive at equilibrium. The database for a computable general equilibrium model does not contain individual transactions that take place in an economy but rather the aggregate economic activity that occurs in an economy during a certain time period. SAM tables are quite often used for this purpose as they are easy to use and they provide a clear picture of transaction flows in an economy (Burfisher, 2011).

Though CGEs provide a lot of possibilities for simulations and prediction about the effects of shocks to the economy, they have some drawbacks. Most importantly, CGEs are based on theoretical assumptions, and their databases rely on SAM tables that are already quite dependant on theoretical assumptions. In other words, the model is as good as the underlying assumptions are and there are many of them.

Microeconomic tools such as the *Instrumental Variables Approach, Propensity Score Matching and Randomized Controlled Trials*[49] are the most commonly used tools in impact evaluation, they will not be considered in depth as infrastructure investment projects are very often affected by macroeconomic factors that cannot be taken into account using microeconomic methods of evaluation. Furthermore, these tools are only useful for ex post analysis, meaning that they can only be used to evaluate the effects of programs that have already been implemented, while macroeconomic tools provide opportunities for performing policy simulations that can provide insight in potential future effects of policies and investments.

Brief, infrastructure investment will, under normal circumstances, have a positive economic and social effect and, as a result, improve the labour market situation of the benefitting local area. The precise value of this impact is difficult to estimate ex ante, as

[48] Adaptations such as the structural VAR (SVAR) can be used to test hypotheses based on assumptions that cannot be tested using regular statistical tools (Lutkepohl, 2007).

[49] The World Bank Handbook on Impact Evaluation (Khandker et al., 2010) provides more information about each of the methods together with some case studies.

there are many behaviours related to these effects, which are unknown and have to be assumed (according to economic theories) in above-proposed methods.

Annex 4: Report-based employment monitoring and public investment priority setting: the case of Paraguay[50]

A. Conceptual framework:

Definition and description of the method

Background

In early 2007, the Paraguayan Ministry of Finance (MF) requested the ILO to develop a methodology to set priorities in public investment according to their impacts on employment and, at the same time, to assist in improving an Employment Monitoring System. Both developments were to be included in a Public Investment System (PIS) to be implemented in the near future. Due to the delays in the implementation of the overall PIS, this was not applied.

In 2009 the priority setting method was briefly adjusted to monitor employment in the Anti-crisis Plan that was to be implemented by local governments. The newly created system is based in the emission of reports per project and may be applied at macro (within the national PIS), meso (in national-scope programmes) or micro (in specific projects) levels.

Building up the method

Employment measurement

The first part of the study provides a conceptual and operational framework to estimate the share of employment created by each Public Investment Project (PIP). This requires setting criteria and developing tools to produce ex-ante estimates (during the pre-investment phase) of the direct and indirect employment the PIP is expected to create, together with ex-post measurements on the actual number of jobs created after the project's implementation.

Public investment priority setting method

The second part develops a matrix-based method for prioritizing PIPs, based on the use of indicators elaborated according to the social assessment of projects and their employment creation capacity, including a gender equity approach. Additionally, the matrix applies a set of “weighting factors” that allow the PIPs that best match State and Government policies to be “rewarded”. By applying the matrix to a defined set of projects, these projects can be listed in order of priority so that the Ministry of Finance (MF) can assign the investment resources – both local and national - necessary for their implementation.

[50] See Sarabia (forthcoming).

Employment monitoring system

The third part focuses on the design of an Employment Monitoring System in Public Investment (EMSPI), which will be applied on a temporary basis until the Public Investment System is finally implemented. The EMSPI issues reports on employment and includes them within project assessment reports. Their main aim is to check that during the investment phase the employment creation levels remain within the parameters established in the pre-investment studies. Another aim is to use the information obtained to measure various factors, such as: improving local governments' and other implementing agencies' ability to correctly predict employment impacts, and to create or optimize employment through public investment policies, according to type of project, investment sector, or location.

Construction of the model

Ex-ante estimate of short-term direct employment

Short-term direct employment is that which is generated during the project's investment phase and follows the implementation schedule of the project. This type of employment may be estimated and quantified during project design. The project planner should calculate the number of jobs to be created during the execution of works, according to the actual implementation schedule of the project. Levels of employment are reported by occupational categories: (i) qualified workers, (ii) non-qualified workers and (iii) administrative and professional staff. In the event that the project does not include an employment estimate, the project planner should report the amounts that will be paid in salaries, sorted by category, in order to enable the assessor to estimate the number of jobs that will be created (steps 2 and 3). If this information is not reported, the assessor should calculate the estimate from the total value of salaries, following these three steps:

Step 1: Total value of salaries of the project **x** % of standard distribution of salaries by type of project = Value of salaries by salary category.

Step 2: Value of salaries of each salary category / average value of salaries of one salary category = Number of jobs estimated in this salary category

Step 3: No. of estimated non-qualified jobs + No. of qualified jobs + No. of professional jobs = Total estimate of jobs created by this PIP.

In order to arrive at a uniform comparison pattern, it is proposed to express jobs in full-time equivalents.[51] In other words, since employment opportunities will vary in duration, the sum of the different short-term jobs generated by the project is converted to numbers of full-time equivalent jobs (EAE).

To that effect, the number of workers in each type of contract is counted: workers on the payroll or workers under non-personal service contracts. Their contracts' duration in months is taken into account together with the expected contract renewals for each year.

[51] The use of the Equivalent Annual Employment (EAE) concept, similar to the concept of full-time equivalents which has been used in this Guide has been proposed. The ECA concept was developed by the ILO Regional Employment Programme for Latin America and the Caribbean (PREALC/ILO) to estimate the number of jobs created by major infrastructure works during the 1970s, e.g. the Itaipú Dam, the biggest dam in the world at that time.

The number of workers hired during a year, regardless of their contract duration, is multiplied by a factor resulting in the equivalent annual employment (EAE), as shown in the Matrix in Table 13.

Table 14. Conversion Matrix of employment created into EAE units, Paraguay

1. Specify the number of terms established by each type of contract

2. Specify the number of renewals planned for each contract, according to their duration

3. Count the expected number of workers to be hired every year for each type of contract and duration

4. Multiply the number of workers under each contract type/duration by the factor

Type of employment	Contract duration (months)	No. of renewals	No. of workers per year	Conversion factor to EAE	Equivalent annual employment (EAE)
Payroll	12	1	10	1.0	10
Payroll	6	2	10	1.0	10
Payroll	6	1	20	0.5	10
Payroll	3	2	30	0.5	15
Payroll	3	1	60	0.3	15
Service	12	1	10	1.0	10
Service	6	2	10	1.0	10
Service	6	1	20	0.5	10
Service	3	2	30	0.5	15
Service	3	1	60	0.3	15
			260		120

4. Calculate the conversion factor into EAE. This factor converts the number of jobs with a duration of less than a year into equivalent annual job posts. It is defined as the division of the duration of the temporary contract by 12 months, then multiplied by the number of times the contract is renewed.

6. No. of EAE of the project

Ex-ante estimate of short-term indirect employment

Short-term indirect employment designates the jobs created during the investment phase, for those not directly involved in the execution of works, but rather in the provision of those goods and services procured by the project.

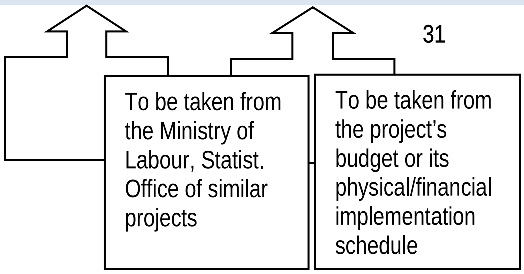
Jobs created as a result of an increase in the project's demand for materials and services, are attributable to that project. This means that any rise in consumption of these factors increases the supplier's employment levels.

These backward linkages are measurable only when the project is big enough to command a significant increase in market share for procured goods and services, thus creating an excess of short-term demand for production and, consequently, in employment. In small projects, additional demand is likely to be met by replacement stocks; and if demand persists, it is likely to be met by extending working hours through overtime, resulting in the generation of additional income rather than in new jobs.

Indirect employment is estimated from the amount of each category of materials used by the project, divided by the average ratio of labour productivity - defined as units produced/number of workers - for the production of that category of inputs. Data is collected from the registers of the Ministries of Industry and Employment or from the National Statistics Office. The results are shown in EAE, following the above mentioned criteria.

Table 15. Hypothetical estimate of indirect annual equivalent employment created, Paraguay

INPUT	Unit	ALP/Year	Demands/year	Indirect jobs	No. of months	Factor	Indirect EAE
Cement	*Units*	50,000	300,000	6	7	0.58	4
Bricks	*Units*	2,000,000	25,000,000	13	7	0.58	7
Doors	*Units*	120	800	7	3	0.25	2
Paint	*Gallons*	1,200	7,000	6	3	0.25	1
				31			14



Note: ALP = Average Labour Productivity

Indirect employment is also the result of outsourced services provided by subcontractors to the project, such as security, messaging, transport, cleaning, image, etc. Requesting data from subcontractors would normally be necessary to estimate the quantity of employment created. In the event that this data is not available, employment may be estimated from the amounts allocated to outsourced services in the PIP's budget, and by making a distribution similar to the scheme suggested for direct employment estimates. However, the estimate may still be difficult to calculate resulting in inaccuracy, so ex-post measurements are advisable. Based on ex-post studies, the Employment Monitoring System is further expected to create a database that sets the standard costs of these services as well as the employment they create.

Ex-post measurement of short-term direct employment

The most accurate ex-post measurement of short-term direct employment generated during the execution of works is obtained from the registers of the project implementation unit. The procedure will be as follows:

Step 1: Counting workers on the payroll. Adding the staff hired for the provision of non-personal services but directly linked to the line of implementation of the project.

Step 2: The number of workers hired throughout the year, regardless of their contract terms, should be expressed in EAE following the procedure shown in the Matrix in Fig.1.

Notes:

- The number of workers is counted by salary category, based on contract duration and the number of renewals made in a year.
- Employment can also be registered by gender, ethnic or geographic origin, provided that this data is registered in the basic information source of the project implementation unit.
- In this case, estimates will follow the logic stated in steps 1 and 2, and the results will be presented according to the purposes of the study.

As payroll registers may be difficult to obtain, data on employment should be taken from the assessment reports of projects, i.e. progress, mid-term or final reports. It is advisable that final assessment reports include reports on employment. To facilitate this information, the MF should develop a standard indicating that PIP's assessment reports - and particularly their final reports – should include information on the number of jobs created.

Ex-post estimate of short-term indirect employment

To measure ex-post indirect employment created, the same theoretical and operational considerations as with the ex-ante analysis apply: the only difference is the source of information. In the case of indirect employment created by an increase in the consumption of materials, estimates are made from real data coming from the accounting closure reports of the project's implementation unit. As for employment generated by services, data should be collected from subcontracting companies, which will communicate the number of workers hired for the services supplied to the project (security, messaging, transport, cleaning, etc.).

Another indirect impact on employment is produced by the increase of local consumption, as a result of the salaries earned by workers hired by the project, and mainly spent locally. For this estimate, specific studies should be carried out in order to find out whether this type of consumption has an impact on employment or only helps to improve income.

Data requirements

For this type of employment impact assessment, several categories of employment data have to be calculated, which can be summarized as follows:

1. To calculate short-term direct employment ex-ante:
    a. *Direct employment to be created by the PIP; or value of salaries to be paid in each salary category; or total value of salaries.*
    b. *Standard percentages of labour force distribution by occupational categories, according to type of project*[52].
    c. *Average value of salaries in each salary category.*
2. To calculate short-term direct employment ex-ante:
    a. *Volume of materials to be consumed by the project in units.*
    b. *Average labour productivity ratio (units produced/number of workers) of each activity producing inputs.*
3. To calculate short-term direct employment ex-post:
    a. *PIP final assessment reports including data on employment created; or*
    b. *Worker's payroll of all salary categories.*
    c. *Recount of personal service contracts linked to the project and their contract terms.*
4. To measure short-term indirect employment ex-post:
    a. *Volume of materials actually consumed by the project in units.*
    b. *Data on staff hired by direct service suppliers of the project.*
    c. *Studies on the use of revenues (consumption) by the employees of the project.*

[52] Calculating this labour force distribution requires identifying the most common types of works undertaken in the country.

B. Practical applications

Type and level of analysis

The method proposed assists in the decision-making process on policy options and contributes to strengthen policy coherence of national development plans and strategies. It gives solid insight into the impact of public policies, in particular those directed towards infrastructure investment using labour or capital-based methods, or towards job creation and related social issues more generally.

It can be used for ex ante estimations of public policies, but its analysis is by nature more robust for ex post evaluation of existing projects, as it can rely on real data. It is appropriate for the evaluation of bigger national programmes.

It allows analysis at three levels:

a. At macro level, by introducing the employment variable in the monitoring of existing or future Public Investment Systems. This requires that, from the formulation stage, Public Investment Projects estimate the quantity of employment they intend to create (ex-ante estimates). During the execution of works, the system should consider issuing progress reports on the number of jobs created (progress measurements). Final assessment and closure reports should reflect the jobs that were actually created (ex-post measurements). The system also measures indirect employment created by estimating the consumption of materials and services in the value chain of the project.
b. At meso level, it is applied in special programmes, such as temporary work, anti-crisis or public employment programmes, aiming to alleviate the negative effects of shocks. In the case of Paraguay, this was done by including a simple report template issued by executive units (local governments). This report sheet is processed by the resource-allocation entity (in this case, the Ministry of Finance through its DTU), in charge of monitoring and supervising the above mentioned anti-crisis programme.
c. At micro level, and in order to monitor the number of jobs created by public investment projects, the same report template may be used. Alternatively, employment may be monitored in progress reports or mid-term and final assessments of projects. The method can show employment data disaggregated by sex, age groups, qualification, etc.

Application

a. Employment monitoring within the National Public Investment System (NPIS) at the macro level

As of October 2010, of all the components of the System, the Project Priority Setting Matrix was the only one being used by the MF. This is because the Government – which took office in August 2008 – considered that the monitoring of employment should be linked to the NPIS. At the request of the MF, the ILO provided support to ensure the mainstreaming of employment as a core element of the NPIS.

b. Employment monitoring within the Anti-crisis Plan at the meso level

As a result of the global financial crisis in 2008-2009, unemployment levels increased in Paraguay. However, this was counterbalanced by the Anti-crisis Plan. Among the measures adopted, supplementary resources were allocated to local governments[53] so that they could develop labour-intensive projects locally. With the purpose of measuring the Plan's impact on employment, and as requested by the MF, the ILO developed a monitoring tool. It further recommended that all local governments issue an employment report in all final project reports, based on a template that was designed especially for that purpose.

Chart 1 shows how the system works. An information sheet is prepared for each sub-project developed by a local government including information on the resources to be monitored. Monitoring reports are passed on to the Decentralization Technical Unit (DTU-MF), which performs electronic monitoring. The DTU processes the information, creates a database and issues reports to the decision-making authority - integrated by other MF departments, the Technical Secretary of Planning and representatives of local governments - for the purpose of taking corrective action if necessary and for future policy development. This authority releases the data on employment created and provides the MF with feedback for the design of public investment policies.

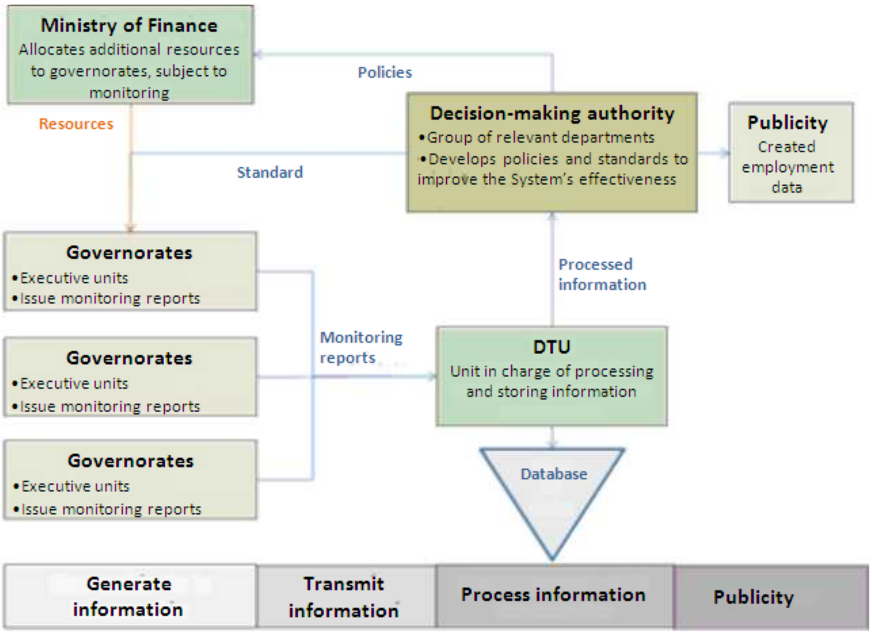
According to a final report issued by the DTU-MF in September 2010, a total investment of US$ 34 million on projects has created 11,125 new EAE jobs. From the total amount, works, goods and services procured from contractors used 57 per cent of the resources and created 5,443 EAE jobs (48.9 per cent), while projects promoted by community organizations (such as paving, cleaning, etc.) used 20 per cent of resources, and created EAE 4,026 jobs (36.2 per cent). In turn, local governments used 23 per cent of the resources and contributed to the creation of 1,656 EAE jobs (14.9 per cent). Neighbourhood organizations appear to be more efficient in the use of labour force.

Monitoring showed that 51.1 per cent of investment was allocated to Infrastructure and Housing, 27.1 per cent to Education and 11.6 per cent to Health and Sanitation. Moreover, the analysis of employment by salary categories shows that 53 per cent of resources have been allocated to non-qualified labour, 31 per cent to qualified labour, 8 per cent to professionals and 5 per cent to administrative staff.

Other analyses, including on gender, provinces, impacts on indigenous communities, productive projects and impacts on indirect employment are also being carried out.

[53] As part of this Anti-Crisis plan, an amount equivalent to US$ 34 million was allocated, an average of US$ 2 million for each of the 17 governorates of the country.

Figure 8. Employment monitoring system operation in Paraguayan local governments



Inputs requirements

The main input required for the implementation of a monitoring and evaluation system through reports is qualified staff to fill out data of a Monitoring Reporting sheet. This implies a thorough planning of training programmes at all levels where the System is functioning. A second important element is counting on an effective mechanism for data transmission to the institution responsible for data processing. Currently, considering the easy access to electronic data transmission systems, this does not cause a major problem. Nevertheless, the establishment of such a system should not disregard this aspect, since irregular internet access would cause bottlenecks for data transmission, rendering the system inappropriate. With regard to the generation of the database and to the processing of information, the major requirement is the availability of relatively simple soft- and hardware, plus staff trained in obtaining information within the expected parameters for the decision-making organ. Data storing and analysis can be done using a standard spreadsheet or data base software platform.

Duration of implementation and cost estimates in work months

The implementation period of such a monitoring and evaluation system (a programme with national coverage) could be rather short. Actions of communication with departmental authorities are necessary so that they can give the order to their respective government entities. Necessary time needs to be dedicated to the training of involved staff: training civil servants who will be responsible for monitoring and training of staff responsible for information processing (one week, part-time). The modalities for monitoring will depend on the type of programme to be monitored. In the case of the PIS, the monitoring is continuous. In the case of the Paraguayan Anti-Crisis Programme, formal reporting took place only after the completion of each sub-project, thereby feeding into the database gradually rather than continuously. This meant that the final evaluation was possible only after the implementation of all sub-projects. This was also the case for the evaluation of one single programme or project composed of different sub-projects.

Training plans and programmes could be implemented at different levels: i) at the local level, training could be carried out in each departmental capital, meaning the training would be more personalized, but at the same time, more time consuming; ii) at the regional level, staff from all departments of one region could be brought together, which would save time for training, but increase its costs as some of them would have to travel to the training location, or iii) at the national level, there would be further time savings due to economies of scale, but nevertheless higher costs due to participants' travel. However, the costs of international consultants responsible for training, often a high share of total project costs, could be significantly reduced as this option would reduce their period of stay in the country (one week, part-time).

C. Conclusions

The major advantages of proposed methodology can be summarized as follows:

1. Most Latin American countries have been implementing National Public Investment Systems with the purpose of ensuring the social or economic profitability of PIPs. In this way, they intend to improve the quality and effectiveness of public investment. However, these systems lack priority-setting mechanisms to allocate resources; and as employment is not taken into account as a factor, it is neither measured nor monitored.
2. The model designed allows monitoring of employment at the macro, meso and micro levels of public investment:
    a. At macro level, by introducing the variable of employment in the monitoring of existing or future Public Investment Systems.
    b. At meso level, it is applied in special programmes aimed at developing works or employment, such as temporary work, anti-crisis, or public employment programmes.
    c. At micro level, it creates a capacity to monitor the number of jobs created by public investment projects, including disaggregated employment data (sex, qualification, age groups).
3. The Government of Paraguay considers that the NPIS that is currently being implemented should have a priority setting mechanism for investments which takes into account employment creation, including a gender component, as a factor to decide on resource allocation. This mechanism should encourage executive units to hire more workforce so that their projects are ranked higher than other less labour-intensive projects. Furthermore, the Government considers that monitoring employment should be a core element of the NPIS.

In brief, the model – originally developed to be applied at the macro level as a standard practice – is also applicable, with a slight adjustment, at the meso level, and even at micro level. The progress made may set the basis for further promotion of employment monitoring at the three levels.

The limitations and the remaining challenges related to this method are as follows:

The proposal's implementation requires that a political decision be taken to adopt employment monitoring as a common practice within public investment systems, which implies reviewing standards, procedures and customs. Only then, will the State administrative procedures be adapted to ensure that the implementation of public investment projects will take employment into account as a core element driving public investment policies in countries. Also the current employment impact investment methodology being applied to public investment programmes does not fully take into consideration the economy wide effect that a specific public programme may have. Therefore future work could consider developing a complementary, and more comprehensive, impact assessment tool.

Annex 5: Methodological issues for undertaking a comparative study on labour-based and equipment-based road construction in Cambodia[54]

In undertaking a study comparing labour-based with equipment-based road construction in Cambodia, it was initially envisaged that a purely financial analysis of selected projects could be carried out, which in the turn would be complemented and then expanded on with additional data to arrive at an economic analysis of the costs and benefits of the various projects. This would have been a straightforward exercise if all relevant data was available and the different projects being compared were of similar technical standards. In reality, the sample group of projects was limited, due to a general lack of concise information on actual costs and their breakdown into skilled labour, unskilled labour, equipment, materials and overhead costs. Furthermore, considerable differences were found in the design specifications, construction methods and implementation modalities.

As a result (besides collecting the correct financial data), this study had to investigate the types of implementation and work organisation, the labour and equipment content, and the operational and financial factors that had been considered by the agencies and organisations in establishing their cost calculations. Only with this breadth of data was it possible to draw some conclusions as to the economic costs and potential employment and capacity building benefits. To arrive at this, the following framework in seven steps was followed.

(i) Pre-assessment of data availability

During the inception of the study, an overall assessment was carried out to determine data availability. Not only the availability of information on actual costs, but more importantly information on the breakdown of cost into skilled labour, unskilled labour, equipment, materials and overhead cost was examined. A stringent criteria was applied to accept only actual data, because pre-construction cost estimates might not reflect the true cost of the actual works. In addition, the focus thus had to be limited to completed roads, to avoid distortions as gravel, earthworks and drainage will not be exactly in phase during the entire construction period. The disadvantage of this approach is that the available data was severely reduced, as not all projects kept exact records in sufficient detail of all needed data. The advantage, however, was that the data collected would be more reliable and valid, as this was actually measured during construction and not estimated. During this stage, data was also collected on economic time series that would be needed for the financial cost adjustment.

(ii) Selection of sample group

A sample group was established on the basis of the pre-assessment. It was attempted to obtain a sample group that would be balanced in terms of technology choice (labour-based or equipment based) and in terms of implementation modalities (force account or contracted out works). Strict adherence to this balanced approach would have had severe repercussions on the sample size for the reasons mentioned above. For this reason, it was decided to accept over- and under-representation of certain categories, but to refrain from

[54] Source: Munters, 2003.

generalist conclusions regarding these categories without explicit comments to substantiate the arguments presented.

(iii) Data collection

Financial data was collected for each project. During the collection of project data information on contracting practices was also collected. Most of this data related to the type of equipment used during the implementation, methods of cost-calculation, hiring rates of equipment, and accounting and other financial problems encountered during the implementation. This best captures the hidden costs in any operation, which may include equipment breakage, management failures during planning, delays caused by weather, mistakes that had to be rectified, and unanticipated site conditions (although this should be minimal for this type of work). Also, a large portion of the roads was visually inspected in order to assess the quality of the work delivered.

(iv) Cost Analysis and Breakdown

The collected data was broken down into unit cost rates and average volumes of work required per kilometre. In particular, the Ministry of Rural Development (MRD) kept excellent and up to date records of the performance of the Rural Infrastructure Improvement Project (RIIP). This information was already compiled and categorised into skilled labour, unskilled labour, equipment, materials and overhead costs. For this reason, the RIIP data set was accepted as the benchmark to which the other projects would be compared and normalised (ref. Step (v)).

It, however, proved necessary to adopt somewhat different approaches to analysing the data of other projects in order to come up with a meaningful comparison. While all projects kept records of their overall costs, some have very limited data on the actual quantities of work involved, other than the length of the road, not to mention a breakdown into equipment, labour, materials, etc. Therefore for some projects, estimations and conversions were made for the missing information on the basis of what could reasonably be expected in comparison with the data available from the RIIP.

Originally, it was also intended to capture the overhead costs for client supervision. This would allow a comparison between the consultancy costs necessitated by contract management as opposed to the force account costs attributable to head office supervision. In practice, no accurate data could be obtained from the ILO or MPWT to represent their input. RIIP overhead costs was approximated to 7 per cent on the basis of the funds the project allocated to MRD to cover their counterpart costs at central and provincial level, but this did not cover technical assistance, which played a large role in the training and overall control. Similarly, most consultants estimated per cent as their design and supervision costs over and above the contract costs.

However, there would still be a client cost which is not covered by this estimate. It was therefore decided to omit the client supervision costs from this exercise. The on-site supervision costs, however, are captured throughout.

(v) Normalisation

Besides the fact that MRD had the information readily available on the RIIP, and the considerable size of their works implemented, the technical specifications that were used have been accepted as the official rural road specifications. Accepting these specifications as the research standard thus has a double advantage. It not only avoids recalculation of the largest part of the data available into a different standard, but also leaves the data in its original form, in accordance with the design specifications of Cambodia and thus the research results can easily be referred to.

For this reason, all data collected on the volumes of work in other road projects was adjusted to comply to this standard, if they did not already. Further, on the basis of the RIIP project data, an average number of culverts and bridges per kilometre was estimated. Together with the technical specifications, this is referred to as the "1 km benchmark". Normalising the other projects to these specifications allowed comparison on equal grounds.

(vi) Inflation adjustment (omitted)

After adjusting the data to meet the technical benchmark, the data was originally corrected to 1999 prices. Adjustment for inflation during the construction period would normally be carried out using a dedicated

Construction Price Index that follows the variation in key supplies (cement, diesel, steel, labour costs, etc.). This index is not yet established in Cambodia. The alternative, the Consumer Price Index, does not properly reflect the situation in the construction industry.

It is apparent that in US Dollar terms there has actually been a decrease in the costs of some key construction items up to 1999. Given the fact that labour payments have remained constant, indexing of construction costs to increase by 2 to 3 per cent each year in line with the CPI would therefore seem unwarranted.

Apart from two ILO Labour-based Rural Infrastructure Rehabilitation Project roads built in Seam Reap between 1995 and 1997, all works reviewed in this study have been carried out between 1998 and 2000. In addition, all costs have been recorded in US Dollars. It was therefore decided that adjusting for 1999 prices is an unnecessary complication in this case, and the omission would not significantly detract from the veracity of the comparison.

(vii) Comparison

After the appropriate adjustments and normalisations had been made, an overview was prepared, presenting the various costs and cost breakdowns of the projects covered by this study. These projects were grouped into technology type and implementation method. Weighted averages of these cost and their breakdown of the various sub-groups were reviewed and discussed before drawing up the final conclusions and recommendations.

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