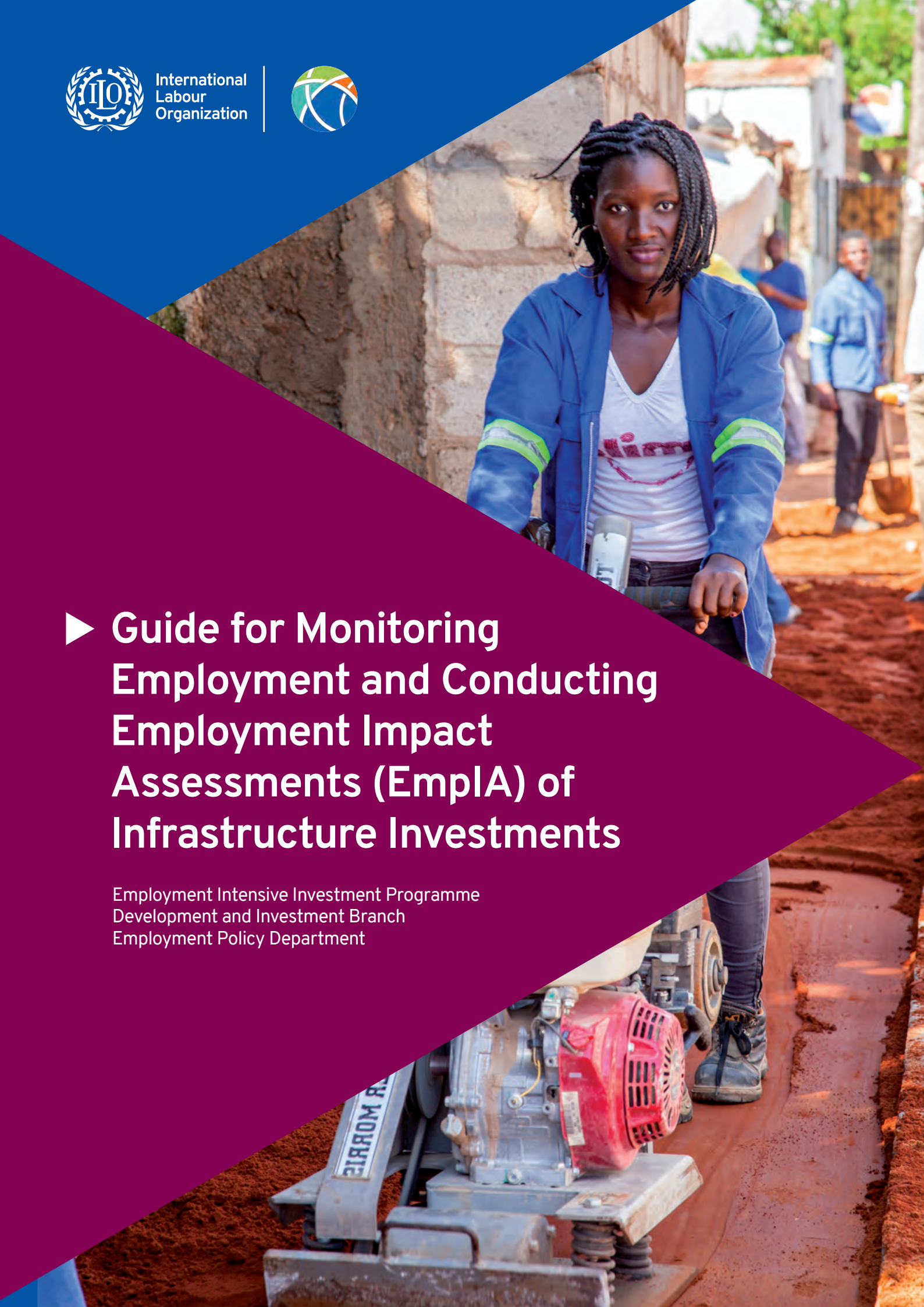

Guide for Monitoring Employment and Conducting Employment Impact Assessments (EmpIA) of Infrastructure Investments

Employment Intensive Investment Programme
Development and Investment Branch
Employment Policy Department

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Preface

Employment is a key driver for development as it constitutes a bridge between economic growth and poverty reduction. People and households get out of poverty most often by moving into more productive and decent jobs or improving existing jobs. Placing the aim of achieving full and productive employment at the heart of development policy is therefore critical for reducing and eventually eliminating poverty, reducing inequality and addressing informality. This is also globally recognized with the adoption of Sustainable Development Goal (SDG) 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all."

The European Commission (EC) and the International Labour Organization (ILO) both recognize that, in order to achieve SDG 8, it is critical that full and productive employment be at the heart of development policy. In the "New European Consensus on Development", the EC emphasizes the importance of targeted policies in developing countries to promote the engagement of citizens - especially the youth, women and potential migrants – in social, civic and economic life and to ensure their full contribution to inclusive growth and sustainable development.

In this regard, the EC and ILO have jointly initiated a project entitled "Strengthening the Impact on Employment of Sectoral and Trade Policies". This innovative project includes developing methods and capacities to determine the effects of infrastructure investments on employment. This project, being implemented in nine partner countries and working with national governments and social partners, aims to strengthen the capabilities of country partners to analyse, design and implement sectoral and trade policies and programmes for more and better jobs.

This Guide is one in a series of project publications that aim to capture the tools and methods developed and used under this project, as well as the main lessons from implementing these in the partner countries. By doing so, the experience and learning of the project can be disseminated to other countries and partners for their benefit, thus encouraging the integration of global and national employment objectives into sectoral and trade policies and consequently supporting the global employment agenda and the achievement of SDG 8.

This is Version 1.0 of this Guide, and as with all guides, it will require revisions from time to time, based on lessons learned from when it is used. It is the intention to revise this Guide based on the experiences and feedback of those who have used it on their projects.

Acknowledgements

This production of this Guide was supported by the project called "Strengthening the Impact on Employment of Sectoral and Trade Policies" (STRENGTHEN), which is implemented by the International Labour Office with financial support from the European Union.

This Guide builds on the collective work and experience with Monitoring of Employment and conducting Employment Impact Assessments of the Employment Intensive Investment Programme of the ILO. It also incorporates the experience and lessons learned from conducting Employment Impact Assessment of Infrastructure investments as part of the STRENGTHEN project. The inputs and comments provided by stakeholders, consultants and experts in the partner countries when conducting and validating these assessment were also incorporated.

This Guide was prepared by Maikel Lieuw-Kie-Song (Infrastructure Specialist ILO). Others who contributed to parts of the guide are Haile Abebe (ILO), Shereen Abbady (Independent Consultant, Jordan), Kirit Vaidya, and David Morris (Aston Business School, UK). Chris Donnges and Terje Tessem provided valuable comments and suggestions on the Guide. In addition valuable comments and inputs on relevant EmpIA studies were provided by David Cheong, Matthieu Charpe, Marek Harsdorff and David Kucera (ILO).

Disclaimer

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Abbreviations and acronyms

BOO	Build, Operate and Own
CGE	Computable General Equilibrium
DySAM	Dynamic Social Accounting Matrix
CI	Capital Intensive
EEAA	Egyptian Environmental Affairs Agency
EIIP	Employment-Intensive Investment Programme (ILO)
EmpIA	Employment Impact Assessment
EPWP	Expanded Public Works Programme (South Africa)
EO	Employment to Output (ratio)
EU	European Union
EUR	Euro
FTE	Full Time Equivalent
LGBT	Lesbian, Gay, Bisexual and Transgendered
GNI	Gross National Income
IFC	International Finance Corporation
ILO	International Labour Organisation
IOT	Input-Output Table
ISCED	International Standard Classification of Education
ISIC	International Standard Industrial Classification
KII	Key Informant Interviews
LI	Labour-intensive
LIC	Low Income Countries
LMIC	Low Middle Income Countries
MAD (DH)	Moroccan Dirham
MENA	Middle East and North Africa
MIS	Management Information System
M&E	Monitoring and Evaluation
OECD	Organisation for Economic Co-operation and Development
O&M	Operation and Maintenance
PM	Project Management
PMU	Project Management Unit
RMF	Results Measurement Framework
SAM	Social Accounting Matrix
SDGs	Sustainable Development Goals
SIC	Standard Industrial Classification
TOC	Theory of Change
TOR	Terms of Reference
T I	Type 1 Multiplier
T II	Type 2 Multiplier
USD	United States Dollar

Introduction

Infrastructure investments are critical for achieving the Sustainable Development Goal (SDG) and it is estimated that the achievement of 92% these goals is influenced by the availability or improvement of related infrastructure. It is also important to note that these infrastructure investments are required across the globe. In least developed countries the infrastructure that ensures access to basic services such as safe drinking water, electricity and all weather access to markets and schools is still inadequate. 'Today the infrastructure gap is huge: 940 million people live without electricity, 663 million lack improved sources of drinking water, 2.4 billion lack improved sanitation facilities, one billion live more than two kilometers from an all-season road, and four billion people lack internet access[1]. On the other side, many developed countries also require massive investments to improve their existing infrastructure, much of which is approaching the end of its economic lifespans. For example recent estimates have placed the infrastructure investment required to support the achievement of the SDSs at **US$6.3 trillion per year** until 2030[2].

These massive investments will have important impacts on employment and the labour market. While short-term job creation is seldom the primary objective of an infrastructure investment, enhancing qualitative and quantitative employment outcomes is increasingly seen as one of the developmental impacts of infrastructure investments that need to be optimized. For this reason, there is an increasing interest in assessing and capturing these effects[3]. For the International Labour Organization (ILO), working to increase and enhance the employment outcomes of such investments is core to its mandate.

During their construction, infrastructure investments generate significant employment in the construction as well as related sectors that provide its inputs. At the same time, they can also be used strategically to improve the quality of employment in these sectors. Globally, there is an increased interest in monitoring these employment impacts so that these can be better understood and factored into National Development Plans and National Employment Policies. At the same time such knowledge can help to strengthen the use of infrastructure investment as a policy response to the negative employment effects of economic downturns and other types of crises. The type of knowledge and data collected through applying this guide will enhance this understanding and contribute to enhancing the employment outcomes of infrastructure investments.

This guide supports the monitoring and assessment of the short-term employment impacts of infrastructure investments, i.e. the effects during the construction process. Its target audience is people involved in the planning, design, execution and operation of infrastructure investments. These, many of whom are not economists are often still required to account and report on the employment outcomes of these investments. The purpose of this guide is to provide practical methods and approaches which can be used by project managers and monitoring staff without a background in labour or macroeconomics. Only for the methodology proposed in **Unit 4** a macroeconomist or labour specialist is required. In this sense **Unit 4** is intended to empower staff responsible for infrastructure planning and implementation to commission a study using the proposed methodology.

While it is known that in the long-term infrastructure investments also have impacts on lowering production costs, increasing labour productivity and creating new business opportunities which in turn have profound impacts on employment, these effects are not within the scope of this guide, as they require fundamentally different approaches and methodologies to assess. The task of assessing these also generally falls to a different audience.

1 World Bank Report (2019) Beyond the Gap – How Countries Can Afford the Infrastructure They Need while Protecting the Planet

2 https://www.oecd.org/env/cc/g20-climate/Technical-note-estimates-of-infrastructure-investment-needs.pdf

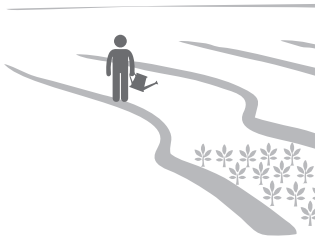
3 For example the EU's External Investment Plan has Job Creation as one of its objectives (link) and the IFC has included employment one its core operational objectives.

This Guide is primarily based on the experience of the ILO in this area of work. It reflects practices and learning from ILO technical cooperation, projects and studies in amongst others Jordan, Lebanon, Morocco, Tunisia, Egypt, South Africa and Indonesia. It also includes the learning and experience from the Strengthen project in Rwanda and Ghana, and so aims to fill gaps that have been identified in the process. A number of other guides and publications by other agencies were also reviewed in the process. What is proposed is thus also an improvement on the current practices within the ILO. But it is written as a guide that can be used by any organization interested in the employment impacts of its infrastructure investments. The Guide also aims to introduce more rigour, consistency and coherence so that results and data obtained can be compared, aggregated and analyzed.

The guide also recognizes that it is possible, and in some cases desirable, to conduct even more in-depth and rigorous impact evaluations, using more sophisticated methodologies such experiments or quasi experiments, as well as economic models such as Computable General Equilibrium models (CGEs). But these methods require substantial involvement of specialists, as well as additional data collection and are outside the scope of this Guide[4].

This guide consists of four Units. Units 1 and **2** provide practical guidance to project managers and staff responsible for Monitoring and Evaluation on reporting the direct employment outcomes of their projects. **Unit 1** provides background to employment and infrastructure investments and presents the analytical framework of how infrastructure investments impact on employment during the construction process. This framework provides the basis for how the indicators and methods presented were selected. **Unit 2** elaborates on the different indicators that can be used to monitor and measure employment effects. It distinguishes between indicators which can be measured from standard project information and thus be used in the regular progress reporting, and those that can be included when more in-depth studies are conducted. It also presents how the relevant employment indicators and results can be integrated into regular monitoring and reporting, during planning, implementation and upon completion.

Units 3 and **4** provide guidance on how more in-depth Employment Impact Assessments can be done, with **Unit 3** addressing the direct effects and **Unit 4** the indirect and induced effects. As these in-depth assessments would usually be done by a consultant these units are intended to assist project manager with developing a Terms of Reference and interpret the results from these assessments. **Unit 3** provides guidance on conducting more-in depth studies of the direct employment effects, in particular on how to commission such a study. The guide concludes with **Unit 4** which describes the links between the direct and indirect effects. It also explains how multiplier analysis using an Input-Output Table (IOT) or Social Accounting Matrix (SAM) can be adapted for assessing the employment effects of infrastructure investments. This Unit is accompanied by a detailed methodological Annex.



4 For these methods reference can be made to a number of other Strengthen Publications in the bibliography.

The ILO's **Employment Intensive Investment Programme (EIIP)** is implemented through global, regional, national and local programmes, funded by governments and development partners, and include sectoral, national or local infrastructure programmes, public work programmes and public employment programmes. Over the years, EIIP has developed a comprehensive package of product lines, covering

the following six thematic areas:

- Employment impact assessments
- Public and private sector development
- Public employment programmes
- Green works
- Local resource-based approaches and community infrastructure
- Emergency employment

More information on these can be found in the EIIP Programme document on the EIIP website: **www.ilo.org/eiip**

China. 2007. Crozet M. © ILO

▶ UNIT 1

A Framework for assessing employment effects of infrastructure investments

1.1 Measuring and Monitoring Employment effects

Measuring and monitoring employment effects of any intervention is generally challenging, because employment has a multi-dimensional nature as well as various qualitative and quantitative features. Furthermore different groups in society such as youth or women may be affected differently by such an intervention, and so there is often an interest to have data broken down by characteristics of workers, such as gender, age, educational achievement or qualification. Monitoring and measuring all these dimensions requires a large number of indicators. For most infrastructure projects it would be too costly and time consuming to include so many indicators in their Results Measurement Framework (RMF).

While there are practices on what employment related indicators to use when designing the results measurement for infrastructure investments[5], this guide aims to introduce some standardization in this. The ILO, which through its Employment Intensive Investment Programme (EIIP) has extensive experience with implementing and supporting labour-intensive (LI) infrastructure investments, also does not currently have a fully standardized framework that is used systematically on all its projects. This guide proposes such a standard framework to be used by the ILO, but which governments and other development partners can also adopt.

This guide recommends an approach for the monitoring of all infrastructure investments where the employment effects are of interest. It recommends the use of five core indicators for monitoring and assessment of the employment effects. These indicators presented in Unit 2 are designed in such a way that they can be used to monitor the direct employment effect generated, while at the same time being consistent with results obtained from estimating the indirect and induced effects, which are derived using different methodologies. They can also be used in all the assessment phases (ex-ante, implementation and ex-post).

Before continuing, it is important to provide a note on terminology used in this Guide. It uses the term infrastructure investments, to refer to projects, a portfolio of projects or programmes (consisting of multiple similar projects). The guide can be used in all of these cases, but some judgement is required on under what circumstances to conduct a detailed assessment as discussed in Units 3 and 4. These are only really sensible and appropriate for relatively large investments.

Before presenting in more detail how employment effects can be measured and monitored, it is important to first outline through what mechanisms infrastructure investments impact on employment. This is presented in the next section through an analytical framework/Theory of Change (TOC). This TOC forms the basis for incorporating employment into a RMF.

5 From a recent review undertaken by the ILO of eight leading International Financial Institutions, it was clear that employment effects were only monitored to a limited extent and not in a consistent manner (ILO 2019b).

1.2 Mechanisms for how Infrastructure Investment impact on Employment: A Theory of Change

The monitoring and assessment of infrastructure investment is generally done in accordance with a results measurement framework[6]. Such a framework generally provides an overview of the anticipated outputs, outcomes and impacts, as well as indicators on how to measure these. Once it has been decided to include employment into the results measurement framework, the processes and mechanisms of how the investment impacts on employment needs to be articulated. This is typically done through a Theory of Change (TOC). For infrastructure investments the mechanisms through which these investments impact on employment in the short-term are generally well understood and presented in **figure 1**.

The blue boxes in **figure 1** represent economic effects, measured in monetary terms. The purple boxes represent effects on the quantity of employment, and the dark blue boxes effects on the quality of employment. This guide focuses on the measuring and monitoring of the effects represented by purple and dark blue boxes. Similarly the solid arrows represent financial flows, and the dashed arrows non-financial measure or outcomes. The text above some of the arrows denote the different **measures** available to the organization making the investment to influence the employment outcomes.

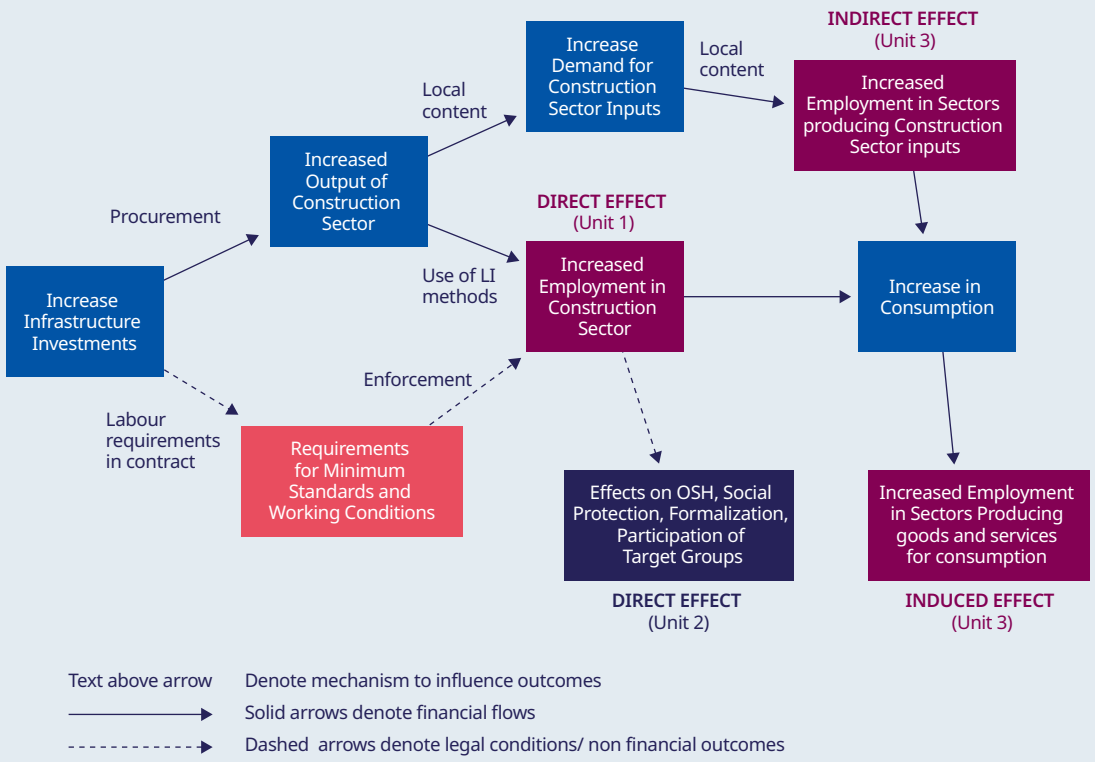
In summary, the TOC is that through increased infrastructure investments the output of the construction sector is increased. This in turn increases employment in the construction sector as additional labour is required to produce the additional output. This is the **direct effect**. At the same time, increasing the output of the construction sector also requires increasing the non-labour inputs such as construction materials to the sector. This in turn increases the outputs of sectors that produce these inputs, in turn triggering demand for labour in these sectors. It should be noted that as these sectors in turn require inputs, this effect occurs over multiple cycles, which is called the multiplier effect. Increased employment triggered by the increased demand for construction sector inputs is called the **indirect effect**. Finally, if employment in the economy increases, this triggers increased consumption by those who are now employed or whose income has increased. This again triggers employment in the sectors that produce consumer goods and services. This is the **induced effect**.

In addition to these effects on the quantum of employment, the infrastructure investments can also have effects on the quality of employment, in particular in the construction sector. If the client includes conditions for labour standards, working conditions and employment equity, and ensures that these are enforced, the investment can also have an impact on Occupational Safety and Health (OSH), Social Protection, formalization and the participation of target groups who have more difficulties finding employment.

While there may be specific variations in different contexts, this TOC can be applied to most infrastructure investments and forms the underlying logic for this guide.

6 Result measurement frameworks are also referred to Monitoring and Evaluation Frameworks, and come in many shapes and sizes. The Logical Framework (Logframe) has been the most widely used in development projects, but increasingly other approaches are also used.

Figure 1. Theory of Change for effects of infrastructure investments on employment (During Construction Phase)



It is also worth discussing the different measures that investors have at their disposal to influence employment outcomes, as in the end Employment Impact Assessments are meant to provide the insights to enhance employment outcomes and so should assist in identifying which of these measures to use and how to put them into effect. The four main mechanisms available are: procurement and contracting, the choice of technology, in particular the use of labour-intensive methods, local content requirements and choice of materials, and the inclusion and enforcement of minimum labour standards and working conditions. These are discussed in more detail in **Table 1.1**.

Table 1.1
Measures to influence the employment outcomes of infrastructure investments

Measure	Notes
Procurement and Contracting	The procurement process and strategy is the primary measure that investors have for influencing employment outcomes. Examples are strategies to deliberately involve SMMEs or include provisions to ensure the participation of domestic firms. The investors (client) can also include certain employment outcomes in the contract document such as provisions for equitable employment of women and youth. Procurement choices may also include the option of government implementing works directly rather than contracting a firm which will also have different effects on employment.
Use of LI Methods and design	Requiring the use of LI methods during construction is one of the key measures promoted by the ILO to enhance employment outcomes. This can increase the employment generated by up to 500%. How infrastructure is designed also impacts on the construction process and in turn on the employment generated.
Local content requirements and choice of materials	Through specifying materials that are produced locally, the indirect employment effects within the locality can be increased. Also some materials are more labour intensive to produce than others, so even the choice between two locally produced materials can have an impact on the indirect employment
Labour standards and targeting requirements	By including standard and appropriate labour provisions, the investor can make it mandatory that these standards are complied with or penalize the contractor in case these are not met. Requirements for targeting specific groups can also be included. This approach can impact and the quality of work but also on who is recruited. It is important however that the investor puts in place the mechanisms to enforce these minimum standards.

An important element of Employment Impact Assessment should be to assess whether these measures can be used, are being used, or can be used more effectively. This allows the assessment to then provide concrete recommendations on enhancing employment outcomes of these or similar infrastructure investments.

While the mechanisms through which infrastructure investments impact on employment over the long-term are also known, monitoring and measuring them is not as straightforward. Over the long term, these investments typically have effects such as lowering production costs, increasing labour productivity or creating new business opportunities, which in turn impact on employment. These impacts will depend on the type of infrastructure investment, but also on the overall context in which they are made. Some investments may generate all of these effects. For example, an investment in energy related infrastructure could have all these three effects at the same time, and each of these would have to be analysed and assessed separately. This becomes a very elaborate exercise that also requires monitoring impacts over the long term and falls outside the scope of this guide. The only long-term effects this guide will cover is the labour demand generated by the operations and maintenance needs of infrastructure investments.

The exact manner in which employment is made part of the results measurement framework will depend on the degree to which employment creation is an objective of the investment. This can vary significantly, and a rural feeder road construction programme may attach much greater importance to its employment creation objective compared to a programme to construct a sewage treatment plant. It will thus be up to those formulating and designing the project to decide the extent to which employment is one of their objectives. If it is one of the objectives, it is necessary that it is included in the results measurement framework. The indicators and approaches presented in the subsequent units provide guidance on this.

Tunisia. 2016. Crozet M. © ILO

▶ UNIT 2

Monitoring and reporting of the direct employment effects of infrastructure investments

2.1 Core data

Assessing and monitoring employment effects requires suitable data which can be used to derive employment related indicators. It is proposed that four types of data, which we will refer to as core data is used on all projects. The general principle used to select these is that this data can be collected from existing evidence and records from projects and programmes and at the same time is comparable with data obtained from other sources such as labour force surveys.

These four types of core data are:

1. Number of persons employed
2. Total quantum of employment (measured in hours/days/months/years worked)
3. Total wages paid
4. Project expenditure

For the first three indicators it is recommended that they are broken down by gender and age (or youth/non-youth). This may not always be possible, and is discussed in more detail further down.

Table 1 provides the definitions of these four types of data as well as observations and explanatory notes on their use and interpretation. The first three are employment related and can be used for reporting by themselves. The fourth indicator is not an employment indicator, but it is required for calculating performance-based indicators. As they are primary data, they should ideally be collected at the project or site level and reported from there. Furthermore, these indicators should be integrated into regular progress reporting requirements. Specific issues related to some of these indicators are discussed below.

2.1.1 Availability of the information and data

A careful review of the indicators makes it clear that all this information is generated and recorded as part of the project implementation and the salary payments of workers. These indicators thus do not require any additional recordkeeping or data collection. What it does require however is planning, and a system that will make it feasible to extract or collate this information to generate reports. If not planned in advance, it may be difficult and time consuming to obtain these later as, records may not be kept in a manner that makes it easy to extract this information to report in the proposed format.

Table 2.1
Core data to be collected for all investments

Information/Indicator	Definition	Observations and explanatory notes
1. Number of persons employed, with gender and date of birth. (END OF PROJECT)	**Total number of distinct person employed on the project or programme over the reporting period, with records on their gender and date of birth.**	This indicator demonstrates how many persons have benefitted from working on the project. It should be seen as a headcount, or if ID numbers are used for registering workers, the number of distinct ID numbers should be used. Gender and date of birth should be recorded so that it can be broken down by gender and age. Care needs to be taken when aggregating, as the same people could be working on a project over multiple reporting periods and as such these results cannot simply be added up over each reporting period. For this reason it may be most practical to only report on this indicator at the **end of a project**.
2. Number of days or months worked broken down by gender, youth*	**Total number of days or months worked by all workers on the project over the reporting period.**	This indicator measures the total amount of labour input provided on the project. Whether to use total days or months will depend on the project. Whatever unit is used, care should be taken to also record the usual number of hours worked per day and days per month. As these may vary from country to country this is important to enable the correct conversion of units. It should be broken down by gender and whether the persons are youth in order to distinguish between the labour inputs provided by these groups. This indicator is easily aggregated over reporting periods by simply adding up all the hours or days worked in each reporting period. This indicator forms the basis for calculating Full Time Equivalents (FTEs) which is discussed in more detail below. This indicator should be used for regular progress reporting.
3. Wages paid (broken down by gender, youth)*	**Total amount of wages paid in local currency for all labour input provided over the reporting period.**	The total wages paid should correspond to labour inputs reported in indicator 2 above. Wages should be based on gross salaries, and social security and insurance contributions should also be included. Salary information is often more difficult to obtain because of privacy concerns. However efforts should be made to also break down the salaries by gender and youth. This indicator is easily aggregated over reporting periods by simply adding up all the salaries in each reporting period. This indicator should be used for regular progress reporting.
4. Project expenditure*	**Total expenditure on the project in local currency over the reporting period.**	This should be the total cost of the capital investments, including salaries on the project over the reporting period in local currency. Non site related overheads such as HQ staff should not be included. This indicator is easily aggregated over reporting periods by simply adding up all expenditure in each reporting period.

2.1.2 Definition of youth

While the UN has defined youth as persons between 15 and 24 years of age, member states are free to use their own definition. It should also be noted, that this definition of youth is not chosen to specifically monitor youth employment. This can cause difficulties in countries where employment of those below 16 or 18 is discouraged or subject to specific limitations, and for the purpose of youth employment. the lower age range is thus set higher. In practice the age range used to define who among the employed are classified as youth differs from country to country. For projects in different countries, it is recommended that the definition to be used is upon agreed in consultation with local stakeholders. It may also be decided to use multiple definitions, and that data is collected accordingly, as was done in Ghana by the Ghana Statistical Services for its surveys as shown below.

> **The United Nations, for statistical purposes, defines 'youth', as persons between the ages of 15 and 24 years, without prejudice to other definitions by Member States. Ghana's definition of the youth as contained in the National Youth Policy of Ghana published in 2010 by the Ministry of Youth and Sports, defined the youth as "persons who are within the age bracket of fifteen (15) and thirty-five (35)". For planning purpose the survey would present figures for both UN and Ghana definitions for the youth. (Ghana LFS 2015, p.66)**

Where possible, it is better to obtain the date of birth of workers and subsequently classify them as youth or non-youth. This makes it possible to adjust the findings for different definitions of youth. Furthermore this has the added advantage that for programmes that take a longer period it allows workers who pass the youth age threshold, to be categorized correctly over the entire project period.

2.1.3 Wages paid

The total wages paid or the wage bill reported should include all wages, including project management, professional engineering, technical and administrative staff, and skilled and unskilled workers. If services of consultants are used to provide expert or professional inputs, strictly speaking these should also be included. The wage bill should be based on gross salaries (cost to employer) and also include social security, health and unemployment insurance contributions made by the employer.

2.1.4 Breaking down indicators by gender and youth

It is useful to be able to monitor and analyze how employment differs for specific target groups. This can most accurately be done if the first three indicators (persons, days and wages) are always broken down by gender and age. In most cases, this is only feasible if there is an electronic HR or personnel system from which this information can be automatically extracted. If such a system is not available, this level of disaggregation increases the reporting burden, in particular for regular progress reporting. In such cases this level of detail can be obtained when more in-depth EmpIA studies are conducted.

2.1.5 Converting hours, days or months worked to Full-Time Equivalents

Labour input is typically measured in time, and the units used can be hours, days or months. Because of this it is important that these are converted in a consistent manner. While this may seem straightforward, practices in this regard vary widely across countries and regions. Considerable variations exist in number of hours generally worked per day or week, as well as number of days per week, month or year.

Furthermore hours and days worked typically involve large numbers and are not very useful for communicating effectively. When the general interest is job creation, it is not useful to report the number of hours or days employment generated as these are very large numbers

and people find this hard to relate to job creation. For this reason hours or days worked are usually converted to Full-Time Equivalents (FTEs). A FTE is the number of hours or days worked in a year on what is considered a full time job. It is a useful measure as it is the time based unit closest to a "job". Over the period of a year it is the equivalent amount of time worked as a person in a full time job. However, because it is sometimes equated to a job, there is scope for confusion, and the term is sometimes interpreted or used inconsistently. The definition adopted by the UN is:

> **Full-time equivalent employment[7]: Full-time equivalent employment is the number of full-time equivalent jobs, defined as total hours actually worked by all employed persons divided by the average number of hours actually worked in full-time jobs.**

The essential feature of calculating the FTEs is that is based on the total hours (or days) worked. The number of persons (or posts, positions or work opportunities) does not feature in the calculation. The other part of the calculation is the average number of hours (or days) worked in full-time jobs.

However, the typical or average number of hours or days worked in a year by those in full-time employment varies from country to country. (And even within counties is may vary from sector to sector). To convert this to FTEs requires knowledge of the total number of hours worked in a full-time job per year in the country or region under consideration. It is important therefore that the most appropriate figure or definition is determined in consultation with local stakeholders.

From ILO experience it was found that figures range between 7 and 8 hours of work per day and 220 to 300 working days per year[8]. **Table 2.2** provides an overview of the range of how many hours or days worked could be considered the equivalent of one FTE. As shown, the absence of a universal definition or convention can lead to very large differences in the total number of FTEs calculated. It is therefore critical that the definition of a FTE used, as well as any assumptions are made explicit so that proper adjustments and conversions can be done when comparisons are made.

Table 2.2
Converting hours and days worked to FTEs

	Hours per day	Working days per year	Hours per year (FTE)
Upper bound	**8**	300	2400
	7	300	2100
Middle range	**8**	250	2000
	8	225	1800
Lower bound	**7**	250	1750
	7	220	1540

Once the definition of a FTE is agreed upon, it can be used to convert the hours or days worked into FTEs and used for reporting purposes. So for example if it is decided that FTE is equivalent to 220 days worked per year, a project that created 220,000 days of work would

7 System of National Accounts 2008, paragraph 19.43, EC, UN, IMF, WB and OECD

8 For example, in some studies it is assumed that there are 25 working days in a month, and based on this, a full time equivalent for 12 months would yield 300 working days per year. In many countries an average of 25 days worked per month is quite high however as there are usually months where the number of days worked is lower. Other has used much lower estimates like 2000 hours per year or 225 days at 8 hours= 1800 hours

create 220,000/220 = 1,000 FTEs of employment or 1,000 "FTE Jobs". However if 300 was decided upon, this same project would report to have created 220,000/300 = 733 FTEs. Once this conversion is agreed upon, everywhere where hours or days worked are used above, FTEs can be used instead.

For monitoring employment on infrastructure projects in developing countries, it is not recommended that hours worked are used as this is cumbersome to track in practice. Rather it is proposed that the time unit that is the basis for wage payments is used which is typically either days, weeks or months as this makes tracking time worked and wages paid consistent and easily convertible.

2.1.6 Currency used for reporting

Typically projects costs and wages are paid in local currency and so reporting can easily be done using these. However, for international comparisons, it is common to convert the local currency to United States Dollars (USD). As the USD is also the main currency used by the ILO, most of the data here is presented in USD. For final reports, it is recommended that figures are converted and reported in USD and that the exchange rate used is clearly indicated.

2.2 Using the core data to calculate secondary indicators

The four core types of data presented above can in turn be used to calculate indicators which will provide a more detailed overview of a project. These secondary indicators and how they are calculated are presented below.

Table 2.3
Secondary indicators derived from the core data.

Information/Indicator	Definition	Observations and explanatory notes
5. Labour Intensity (%)	**= Total salaries/ Total project expenditure. (Indicator 3/ Indicator 4)**	This indicator simply provides the percentage of labour costs as part of the total project costs. A higher percentage usually shows a higher employment impact.
6. Percentage of workers that are youth and female	**=Total number of female workers/ total number of workers (Indicator 1)** **=Total number of youth workers/ total number of workers (Indicator 1)**	These two indicators show the percentages of workers that were women and youth. Workers recruited when they were youth but passing the threshold while working on the project can be included as youth workers.
7. Percentages of days/ months worked by youth and females	**=Total number of hours worked by female workers/ total number of hours worked (Indicator 2)** **=Total number of hours worked by youth workers/ total number of hours worked (Indicator 2)**	These two indicators show how the hours worked were taken up by women and youth.
8. Average project wage (Local currency per hour or day)	**=Total wages/ Total hours or days worked. (Indicator 3/ Indicator 2)**	This indicator provides the average wage paid to workers on the project. If indicators are broken down by gender and youth, the average wage for each group can be calculated as well).
9. Average duration of employment (days or hours per worker)	**=Total hours or days worked/ total number of persons employed (Indicator2/ Indicator 1)**	This indicator provides the average duration of employment provided by the project to a worker. It is best calculated at the end of the project.
10. Average total income per worker (local currency)	**= Total wages/ total number of persons employed (Indicator 3/ Indicator 1)**	This indicator provides the average income workers earned from the project. If indicators are broken down by gender and youth, the average wage for each group can be calculated as well).
11. Cost per day of work created (Local currency/ day of work)	**= Total project costs/ Total hours or days worked. (Indicator 5/ Indicator 2)**	This indicator provides a measure of how much expenditure was required to create one day of employment for the project. It can also be used as an estimate of the output per day generated by the average worker (apparent productivity) (This assumes that the total project cost is equal to the total project).
12. Days of work generated per local currency	**= Total hours or days worked/ Total project costs (Indicator 2/ Indicator 5)**	This indicator provides a measure of how much employment is generated per unit of local currency. It is the inverse of indicator 11.

2.3 Regular progress reporting

2.3.1 Description and categorization of the infrastructure investment

The employment effects of infrastructure investment will differ based on the type of infrastructure constructed and this thus needs to be reported. Furthermore to be able to use these indicators to make ex-ante estimates or compare with other investments it is necessary to categorize the infrastructure investment being reported upon. The table below suggests a number of categories. This list is not exhaustive and many projects may include multiple categories. It is therefore also important to include a more detailed project description that will allow for an assessment whether the value of indicators is relevant. Furthermore institutions with large infrastructure portfolios are encouraged to develop categories based on their own portfolio of projects as these are more likely to be suited to their specific needs.

Table 2.4
Categories of infrastructure investments

Main category	Sub categories
Energy	Solar Wind Coal/Gas Power stations Distribution/ Power lines Other
Transportation	Rural roads (LI) Rural roads (CI) Urban Roads (LI) Urban Roads (CI) Highways Rail Harbours and Ports Airports
Buildings	Schools and education related infrastructure Housing Hospitals and health sector related infrastructure
Water supply and sanitation	Water supply Sanitation
Irrigation and watershed management (Green Works)*	Irrigation (LI) Irrigation (CI) Soil and water conservation Forestry Soil and water conservation Flood Control
Dams and dykes	Large dams Small dams

* As per categories used in ILO 2011, Local investments for climate change adaptation

2.3.2 Regular progress reporting during implementation

Once the implementation of a programme or project starts, it is recommended that regular progress reports include figures on employment created to date. For programmes, the regular progress reports would be compiled by aggregating progress from the individual projects in the programme. The Expanded Public Works Programme (EPWP) in South Africa provides an example of such progress reporting, where the national programme reports quarterly on employment created on thousands of individual projects[9].

Project finance, administration and HR staff usually keep records of all this data as they need it to make the correct wage payments to workers and the most effective approach for employment reporting is to work closely with this staff to obtain these figures as required.

If the time worked and wages paid are disaggregated by gender and youth and non-youth it is recommended that these are always checked using the table below to make sure there has been no double counting. The totals of the last column and last row which must add up to the same in order to be correct, and if this is not the case there has been double counting (See also **Annex 1**).

Table 2.5
Summary tables for reporting person-days and wages paid

	Youth	Non Youth	Totals
Men	**60**	40	**100**
Women	**20**	30	**50**
Totals	**80**	**70**	**150**

2.3.3 Indicators to be used for regular progress reporting

For regular progress reporting it is suggested that seven indicators are used. The first three are primary ones presented in **Table 2.1**: No. 2 (days or hours worked broken down by gender and youth), No. 3 (wages paid, broken down by gender and youth) and No. 4 (expenditure to date are used). The reason for using these three is that they can be aggregated by simply adding them up which is important for progress reporting. Because it is incorrect to aggregate the first indicator, (number of persons employed) simply adding up figures from different reporting periods, it is not recommended that it is used in progress reporting. In addition to these three, four secondary indicators, derived from the first three should also be included. The collected data can be processed and presented in the format in **Table 2.5**. In this table USD is used, but the local currency or the currency through which the project is financed could be used if more appropriate. **Annex 1** contains a template which can be used for collecting employment data for progress reporting and automatically calculates the result to present in the same format as **Table 2.6**. **Annex 1** is also available electronically.

9 Such progress reports can be viewed on: http://www.epwp.gov.za/m&ereports.html

Table 2.6
Sample of employment results for a regular Progress report

Reporting Period: 1 Oct 2019 to 31 Dec 2019 Note: Report is cumulative reflecting figures from start of the project on 1 June 2018.		
Indicator	**Value**	
1. Employment generated (days)	**Total** **% to female** **% to youth**	4500 1200 / 4500 = 27% 2500 / 4500 = 56%
2. Wages paid (USD)	**Total** **% to female** **% to youth**	90,000 20,000 / 90,000 = 22% 35,000 / 90,000 = 39%
3. Project expenditure (USD)		290,000
4. Labour intensity (To date), %		90,000 / 290,000= 31%
5. Average project wage (To date)	**Global** **Average for women** **Average for men** **Average for youth** **Average for non-youth**	90,000 / 4500 = 20.00 / day 20,000 / 1200 = 16.67 / day 70,000 / 3300 = 21.21 / day 35,000 / 2500 = 14.00 / day 55,000 / 2000 = 27.50 / day
6. Cost per day of work created (USD/day)		290,000 / 4500 = USD 64 / day
7. Days of work generated per million (Days /USD million)		= 4500 / 0.290 = 15,517 days/ USD million

One issue is to be decided upon is whether the reporting should be cumulative or just cover for the reporting period. Given that the figures for reporting periods can simply be added up to produce cumulative reports, either option can be chosen. For management and accountability purposes, cumulative reports, reflecting progress from the start of the project are usually more useful and these are recommended.

2.3.4 Extracting progress reports from electronic HR systems or Management Information Systems

With the increased use of electronic HR management and payment systems, as well as of mobile based attendance systems and muster roles, the ability to report accurately on employment is potentially much better. These electronic systems make it is possible to report on days worked and wages paid per individual worker. Furthermore it is also possible to report on the characteristics of each worker such as gender and age. Such individual reports can easily be aggregated into a summary report on employment.

This will require however that the relevant project HR is set up to generate these reports. Where this is applicable, it is recommended that at the beginning of the project, the staff responsible for reporting works with HR so that the system is set up to generate these more detailed reports. To avoid privacy concerns, it is recommended that the data is made anonymous (i.e that names are omitted or stripped from the data set).

If such systems are in place, it becomes possible to also include the first primary indicator, *number of persons employed*. A critical requirement here however is that each employee is allocated a unique employee number or code, as this will allow monthly reports to be correctly aggregated and numbers or increased or reduced numbers of persons employed to be traced. Without such a code it will not be possible to report on the number of persons as only the days worked can be aggregated.

2.4 Capturing Direct Employment impacts in Project Completion Reports

2.4.1 Reporting on final employment results

At the end of each project, a Project Completion Report should be compiled by the project manager. The project completion report should contain a section on the employment outcomes with results using the indicators presented in **Tables 2.1** and **2.3**. An example of such an employment section of the project completion report is presented below. These should be based on the final expenditure and employment figures and should also include the total number of person who have worked on the project. It is also recommended that for the final report the days worked are converted into FTEs and local currencies in to USD. However the definition of FTE and the exchange rate used should be clearly indicated. If employment targets were set at the beginning of the project these should also be included in the report. A suggested format for the employment part of such a report is presented in **Table 2.7**. A template for collecting and presenting this data is presented in **Annex 2** and also available electronically.

Table 2.7
Sample of employment related results for a completion report

Indicator	Value	
1. Employment generated (FTE)	**Total** **% to male** **% to female** **% to youth** **% to non-youth** **(1FTE= 230 days)**	50,000 days = **217 FTE** 35,000 days = 152 FTE: **70%** 15,000 days = 65 FTE: **30%** 25,000 days = 109 FTE: **50%** 25,000 days = 109 FTE: **50%**
2. Number of persons employed	**Total** **% to male** **% to female** **% to youth** **% to non-youth**	**420** 280/420 = **67%** 140/420 = **33%** 250/420 = **60%** 170/420 = **40%**
3. Wages paid (USD)	**Total** **% to male** **% to female** **% to youth** **% to non-youth**	**1,243,000** 887,000/1,243,000 = **71%** 356,000/1,243,000 = **29%** 510,000/1,243,000 = **41%** 733,000/1,243,000 = **59%**
4. Project expenditure (FINAL) (USD)		**3,650,000**
5. Labour intensity (FINAL), %		1,243,000/3,650,000 = **34%**
6. Average project wage (FINAL)	**Global** **Average for men** **Average for women** **Average for youth** **Average for non-youth**	1,243,000/50,000 = **24.86/ day** 887,000/35,000 = **25.34/ day** 356,000/15,000 = **23.73/ day** 510,000/25,000 = **20.40/day** 733,000/25,000 = **29.32/day**
7. Average duration of employment	**Global** **Average for men** **Average for women** **Average for youth** **Average for non-youth**	50,000/420 = **119** 35,000/280 = **125** 15,000/140 = **107** 25,000/250 = **100** 25,000/170 = **147**

Indicator	Value	
8. Average income per worker	**Global** **Average for men** **Average for women** **Average for youth** **Average for non-youth**	1,243,000/420 = **2,959** 887,000/280 = **3,168** 356,000/140 = **2,542** 510,000/250 = **2,040** 733,000/25,000 = **4,312**
9. Cost per FTE created (USD/ FTE)	**Cost per FTE created (USD/ FTE)**	3,650,000/217 = **USD 16,820**
10. FTEs generated per million (FTE/USD million)		= 217/ 3.65= **59.5 FTE/ USD million**

The four core indicators and additional seven derived indicators already provide a good insight into the employment generated from an investment. If this is done for all projects, this can also be aggregated, typically into a MIS, to provide data for a programme (for example a social housing programme consisting of many projects). Over time, institutions can build up a database of these indicators, and these can be used for doing better ex-ante estimations. **Annex 4** contains a list of values for some of these indicators for projects in different parts of the world.

2.4.2 Reflections on the employment outcomes

In the completion report the project manager may also reflect on the employment outcomes of the project. If the project had employment targets, the first part of the reflection should compare these targets to the actual outcomes and if there are large discrepancies, these should be explained.

The second part of the reflection should address whether the four mechanisms identified in the TOC in **Unit 1** were used effectively in the project. Four questions to guide this reflection are suggested:

1. Could procurement have been used more effectively?
2. Could LI methods have been used more widely?
3. Could local content requirements have been used or enforced more strictly?
4. Could requirements on labour standards have been included or enforced more strictly?

2.5 Ex-ante estimations and employment targets

Ex-ante estimations are not strictly part of the general monitoring, as they are done before the project starts. However ex-ante estimates of the direct employment effects usually form the basis for any agreed upon targets for direct employment creation. Where such a target is set, it may be required that as part of the monitoring, the intervention reports on progress against these targets. It is therefore important to understand how ex-ante estimates are done and targets are set, so that reporting against the targets can be done in a consistent manner.

Estimates of the direct employment impact of infrastructure investments are generally done based on past experience with similar projects or activities. The main difference is the level of detail of the assessment.

The most detailed estimates can be done during the design and contract preparation phase of a project, as part of the preparation of the Bill of Quantities (BOQ). In order to prepare the BOQ the various types of labour inputs for all the various activities of the project are typically quantified to arrive at the scope of work and cost estimate. The anticipated employment effect can be quite accurately estimated as part of this process. For example, if one part of the BOQ is the excavation of 9,000 m^3 of soil for trenches, and it is known that under conditions similar to the project a worker is capable of excavating 1.5 m^3, then it can be estimated that (9000 m^3)/(1.5 m^3/day) = 6,000 days of work will be created through this activity. Such employment estimations are not always done however as it may not be included as part of the responsibility of those preparing the BOQ. Where feasible it is recommended that such an estimate is included in their contract or Terms of Reference (TOR). A similar method can be also be used at a less detailed level. For example, if from past experience it is known that approximately 50 FTE of employment are generated through the construction of 1 km of rural road. Then for a programme of constructing 90 km of rural road the anticipated employment effect would be 50 FTE/km x 90 km = 4500 FTEs of employment.

Another way to estimate the direct employment is to use the budget estimate of the project and the most relevant figure of FTEs per million USD (or local currency) available. The project budget is then simply multiplied by this figure to arrive at an estimate of FTEs that will be created by the intervention. If the project from which this figure is derived is similar to the intervention to be undertaken, the estimate is likely to be reasonably accurate. (For example if both are for irrigation related activities in the same country). **Annex 4a** provides some figures from past projects that can be used for such assessments. It is advocated however that institutions establish a practice of collecting their own project employment data so as to make more accurate ex-ante estimations. In most circumstances and ex-ante estimation of Indicator 2: total workdays (or FTEs) estimated is sufficient. If data on the other indicators such as past youth participation are available, these can also be used to set targets, in particular if it is an objective to improve on the rate of participation of youth.

A third approach, which is used when there is no project or programme level data available is to use national level data, in this case the national construction sector employment-output ratio. This approach uses the same data to what is used in Input-Output based estimates (See Unit 4). It essentially entails taking dividing the total employment in the construction sector for a given year (in FTEs converted from hours worked) and dividing it by total output of the sector in the same year (in USD millions) to arrive at a figure of FTEs/ million for the sector as a whole. This figure can then be used together with the project budget to make a rough estimate of the direct employment effects. However as this will be based on the national average for the construction sector as a whole, it may be substantially different from a figure that is based on a specific set of activities such as construction of social housing or rehabilitation of rural roads.

Regardless of how the ex-ante estimates that inform employment targets are done, the method and figures used should be clearly explained so that it clear where these targets come from and any discrepancies for actual employment generated at the end of the project can be understood and explained.

Construction workers having work meeting

▶ UNIT 3

In depth EmpIA studies on direct employment effects

3.1 Defining the scope

Policymakers, investors, donors and other stakeholders may be interested in a more in-depth understanding of the direct employment effects of a project and whether these could have been improved. The progress or completion reports in Unit 2 may not be sufficient for providing such insights. They may be interested in more detail on for example wage levels, as well as qualitative dimensions of employment such as the types of skills used on the project, the safety of workers and their involvement in accidents, levels of informality or whether project staff had access to social security. A particular interest may be how the quality of employment generated through the investment compares with that in the construction sector or the rest of the economy. These questions can be assessed through a more in-depth assessment or what we refer to as an Employment Impact Assessment (EmpIA). Such an in-depth assessment of the direct effects can also be combined with assessing the indirect and induced effects. It can be done while the project is active, or at the end of the project. This Unit provides guidance conducting such an EmpIA of the direct employment. The main aims are to ensure that such an assessment provides reliable results, but is also cost effective and delivers results which are consistent and comparable with assessments of other projects.

The scope of an EmpIA will vary, depending on interest and available budgets. It may be the case that there has not been any regular employment reporting so far, or that it was done using only very few indicators. This section will present the approach and methods, which are useful for developing a Terms of Reference for such an EmpIA. The idea is to assist project stakeholders to identify what types of questions and topics can be covered in such a study. Such studies could be done in house by relevant M&E staff but would most likely be done externally through a consultant.

Typical questions that an EmpIA of direct effects would be expected to answer are:

- **How many jobs have been created?**
  This question captures the quantitative dimension of employment and should analyze the number of people employed, person-days or FTEs of employment created and the duration of the jobs. If regular progress reporting is in place, these figures can generally be obtained from these reports.
- **What kinds of jobs have been created?**
  This question captures the qualitative dimensions of employment and should consider indicators such as contract type, skill levels, occupation types, wage levels, formality, occupational health and safety, access to social security and whether jobs were full-time or part-time.
- **Who was able to take up these jobs?**
  This question captures the accessibility and inclusivity dimensions of employment and looks at whether youth, women and people with disability, former unemployed, immigrants, indigenous groups or any other specific groups were able to access the jobs created.
- **Have measures been taken to improve the employment outcomes?**
  This question captures whether specific interventions or requirements where put in place to enhance the employment outcomes and would consider the procurement strategy, technology choice,/ use of labour intensive methods, local content requirements and requirements for minimum labour standards and working conditions.

Not all these questions may be of interest in every study, and the first task is to decide on the scope. This can be done by using questions such as:

- What are the employment dimensions or issues we are concerned about?
- What were the expectations with regards to employment creation and do we need to assess whether these are being met?
- Based on this, (if not yet decided) what is a suitable project or selection of projects to assess? Ideally they are representative of the investment in question. If not feasible to select a statistically representative sample, efforts need to be made to ensure that they are typical.

The question of how to select the project to be reviewed in-depth may require consideration in the preparation of the TOR. This may be obvious when there is only a single project of interest. However if a larger programme, or activity is under review, selecting the project can be more difficult. Ideally, if a large number of projects are involved (for example multiple smaller roads projects which are all part of a rural roads programme), a statistically representative sample could be considered. But this may be costly and so will depend on the available resources. In general the following should be considered when selecting project(s):

- Is the project typical of other projects in the programme- considerations here would be size, implementation approach, nature of the activity, physical conditions where project was implemented. In such a case the findings could be considered to also be relevant more widely, even if they cannot be considered to be statistically representative.
- Is the project still active, or has it been completed, and if so how long ago?
- Are the stakeholders (in particular contractors) open to collaborating on the study, in particular with regards to making project data and information available?

Finally, a project could also be considered, precisely because it is not typical but was particularly innovative, or had specific problems which if better understood could provide valuable learning for how to improve in future.

At this stage it is also important to decide if there will also be a macroeconomic analysis as part of the EmpIA to assess the indirect and induced effects. If this is the case, the type of data to be collected as part of the project/ programme level studies should also include data on the non-labour inputs which are required for the project. The type of data and information to be collected it this case is discussed in Unit 4. The collection of this data can easily be combined with the collection of the detailed employment data and it is thus cost-effective to combine these.

3.2 Data and Indicators for more in depth assessments

3.2.1 Wages

One interest for investors may be to understand how wages on employment generated through the project compare with wages in the rest of the economy or the construction sector. In this case it is necessary to obtain and review national wage benchmarks and related data and compare wages on the project with these.

Table 3.1
Wage levels and benchmarks for comparison of project wages

Information/Indicator	Observations and explanatory notes
1. National minimum wage	The daily or hourly national minimum wage as set legally. Having the national minimum wage makes it possible to compare this with the wages paid on the project.
2. Average and median wage (Or median>)	These can usually be obtained from national statistical agencies. The average wage is the total wages of all workers divided by the number of workers. Median wage, is the "wage in the middle" meaning that half of workers earn below it. The median wage is generally lower than the average. It may be possible to obtain data broken down by gender and age.
3. Average and median wage (Or median>)	Minimum wage that is applicable to the workers in the project. This could be the national minimum, or a sector specific minimum (construction sector) or a regional minimum (province or region). The minimum wage could also be based on a collective bargaining agreement for the sector.
4. Average and median construction sector wage	This will allow the project wages to be compared with the national sector average and median. It may be possible to obtain data broken down by gender and age.

These wages as presented in **Table 3.1** can then be compared to the wage data reported through the investment. If wage data is broken down by gender and youth, gender and youth specific comparisons can also be made.

It may be of interest to also investigate the variation of wages by skill levels and or occupations. In this case these breakdowns of the workers according to these categories are also required. This is discussed below in the section on skills and occupations.

3.2.2 Participation of youth and women

The participation of women and youth is already covered in the core indicators. It may however be of interest to compare this with national data. In this case national data on the participation of these groups should be obtained. These are presented in **Table 3.2**. These can then compared to the results obtained from the investment.

Table 3.2
National data and indicators on the participation of women and youth

Information/Indicator	Observation	Explanatory notes
1. Share of total employment taken up by women (% of total employment)	This share can be based on number of workers or hours worked. Hours worked is preferable as this can be converted to person days .	This will allow the project to be compared with the sector in general with regards to female employment.
2. Share of total employment taken up by youth (as % of total employment)	This share can be based on number of workers or hours worked. Hours worked is preferable as this can be converted to person days.	This will allow the project to be compared with the sector in general with regards to youth employment.
3. Share of employment in the sector taken up by women (% of total employment)	This share can be based on number of workers or hours worked. Hours worked is preferable as this can be converted to person days.	This will allow the project to be compared with the sector in general with regards to female employment.
4. Share of employment in the sector taken up by youth (as % of total employment)	This share can be based on number of workers or hours worked. Hours worked is preferable as this can be converted to person days.	This will allow the project to be compared with the sector in general with regards to youth employment.

3.2.3 Participation of persons with disabilities and other groups

Another area of interest may be to assess whether the employment generated by the investment is taken up by target groups, other than youth and women. One example of this is persons with disabilities, but in some countries it can also include others such as ethnic groups, immigrants or refugees. The assessment can investigate this, but of paramount importance is that the groups are clearly defined before any data collection or survey takes place.

For example in the case of persons with a disability, it is important to note that the definition of what constitutes a disability may not be uniform. For consistency it is recommended that the definition used by the local Ministry of Labour or Employment is used. This is important as definitions used by Ministries of Health or Social Welfare may differ substantially from this. Similar issues may also arise with other groups of interest.

3.2.4 Occupational Safety and Health

The performance of the infrastructure investment in terms of ensuring the occupational safety and health of workers can also be a topic of interest. This can be done through obtaining data on the number of injuries and number of fatalities suffered. Together with the core data the incidence and frequency rates can be calculated. These indicators which can be used for reporting are defined as follows:

- **Incidence rate** = Number of injuries (or fatalities) / number of workers
- **Frequency rate** = Number of injuries (or fatalities) / number of days worked

These can again be compared with national figures as these same indicators are usually also used at the national level. Again care should be taken to ensure that the definition of injury used in national data collection is the same as used on the projects.

3.2.5 Type of contract

The type of employment contract is also an indicator of the quality of employment. The exact nature of the contract used varies considerably from country to county and so it is hard to provide definite categories. However for consistency, and taking into account the characteristics of the construction sector, it is suggested that the main contract types along which workers should be categorized are:

- 1. Permanent contracts
- 2. Temporary contracts
- 3. Casual workers (Very short term) (With contract)
- 4. Casual workers (Very short term) (Without contract)

More detailed descriptions of these contracts are presented in **Table 3.3** and the data to be collected is the type of contract each of the workers on the project is or was employed under.

Table 3.3
Contract types

Contract type indicator	Observations and explanatory notes
Permanent contracts	These are permanent or long-term contracts that extend beyond the project in question.
Temporary of fixed-term contracts	These are temporary contracts typically linked to the project in questions. They have an end date and are usually shorter or for the same duration as the project.
Casual workers (Very short term) (With written contract)	These are very short-term (daily or weekly) contracts. They can be renewed multiple times, but are usually linked to specific tasks or activities within the project.
Casual workers (Very short term) (Without written contract)	These workers do not have a written contract and are usually employed on a daily or weekly basis or specific small tasks.

3.2.6 Skills levels, educational attainment and occupations

The skills levels of workers can also be obtained through records from the personnel or Human Resources departments, on site interviews and possibly a survey. Education levels are often used to categorize workers according to their skill levels, as this is usually the easiest to ascertain. The drawback of this is that in particular in the construction sector, workers may have gained skills from their work experience, but without having obtained formal qualifications. Four indicators can be used to categorize workers by skill and occupation. These are:

- **Skill levels:** as used on the project by the contractors, a typical hierarchy is: low-skilled (unskilled) workers (manual labour), semi-skilled workers, skilled labour (artisans), administrative staff (book keepers, clerks, secretaries) technical staff (technicians, junior engineers, accountants, surveyors), and professional staff (engineers, managers, quantity surveyors)
- **Educational attainment** for example by ISCED levels: (1) ISCED levels 0-2: less than primary, primary and lower secondary; (2) ISCED levels 3-4: upper secondary and post-secondary non-tertiary education, and (3) ISCED 5-8: tertiary education;
- **Job categories** (project management and engineering, technicians, artisans, manual labour workers, other workers, administrative);
- **Wages paid** for different categories of workers, for example workers could be categorized in terms of different salary ranges. One approach to determining the ranges is to set them based on the minimum wage or lowest wage paid on the project.

In order to make these categories comparable with national statistics, it is recommended that as much as possible categories used by national statistical agencies to conduct labour force, establishment and household surveys are used.

3.2.7 Access to Social Security and Social Protection

The extent to which workers have access to social security is an important indicator of the quality of employment. Through the personnel or HR Department, it is relatively easy to assess what share of workers have entitlements to social security and other benefits. Typically an EmpIA will assess what number or share of workers have:

- Entitlements to paid leave (Holidays, Sickness, Maternity)
- Access to Health Insurance (partially of fully paid for by the employer)
- Access to Social Security (Employer pension contributions and participation in Unemployment Insurance)
- Accident insurance coverage

The percentages of the persons employed who have access to these benefits should be reported.

3.2.8 Compliance with the four ILO fundamental principles

The ILO has adopted four fundamental principles and rights in four categories:

- Freedom of association and the effective recognition of the right to collective bargaining;
- Elimination of forced or compulsory labour;
- Abolition of child labour and
- Elimination of discrimination in respect of employment and occupation.

An EmpIA should also aim to assess whether these are being adhered to. The right to freedom of association can be assessed by whether workers are members of unions and are free to organize if they so wish. This question can be included in surveys or interviews of workers. With regards to collective bargaining, in the wage section it was already recommended that it is assessed whether there are wages determined through collective bargaining in the sector and if these apply to the investment. The wages paid in the project can also be compared with the collective bargaining wages.

Assessing that there is no compulsory, forced or child labour can usually be done through site visits and interviews with stakeholders and workers.

The elimination of discrimination is often harder to assess. A general concern in the sector is the discrimination against women, but depending on the local context, concerns about discrimination may also involve minorities, racial groups, indigenous persons, immigrants, and LGBT persons. Assessing this requires knowledge of the local context as well as its sensitivities. The main approach to assessing this is to review whether specific workplace policies to address discrimination are in place, the extent to which there are being enforced and the extent to which these specific groups have actually obtained employment on the project on the same terms as other groups. In the EmpIA report a qualitative assessment of the extent to which these fundamental principles are adhered to should be included.

3.2.9 Informal employment

Informal work is highly prevalent in the construction sector, especially in developing countries. As reducing informality is a common policy goal, insights on the extent to which a project is generating formal or informal employment and is supporting a transition to formality would be of interest. Measuring informal employment is complex and closely linked to the quality of employment. The indicators related to the quality of employment presented are also all indicators of whether employment can be considered informal[10]. It should therefore be assessed within this broader context and recognizing that the quality of employment may vary considerably, even if both are considered informal.

The exact definition of an informal worker varies widely however and it is thus important the national definition is found. Usually, this definition is based on whether workers are entitled or have access to some of the rights and benefits above. Based on the local definition, the type of data collected for the study could be adapted so that employment on the projects can be categorized as formal or informal employment and these percentages can be reported. This can also be compared with national data on the share of employment that is informal. An example is provided below.

Example: Definition of an informal worker in Ghana[11]

Informal employment is defined as employment in an establishment where workers are not entitled to paid holidays or leave, sick or maternity leave and where there is no verbal or written contract at the time a person started to work. Any one the three conditions has to be fulfilled in order for a person to be classified as working in informal employment.

Based on this definition, all those entitled to sick leave, holiday leave and maternity leave AND were provided with a contract would be classified as formal workers. The rest would be classified as informal workers. In the case of the Social Housing project in Ghana[12], none of the casual workers had leave entitlement and were thus all considered informal workers. However all permanent workers met these requirements and could be considered formal.

The assessment should provide an estimate of the share of persons employed who could be considered informal workers. In addition, it should also provide an assessment of any

10 See ILO 2013, Section 2: Measurement of the Informal Economy

11 GSS 2016

12 Abbadi et. Al. 2019

measures that support a transition to formality and this analysis should incorporate the findings on all the qualitative indicators above.

3.3 Methodology: Interviews, site visits, document reviews and surveys

Information and data for an EmpIA can be collected through a combination of interviews, document reviews and surveys. Key Informant Interviews (KII) are usually conducted with various parties involved in the project. These include clients such as ministries and funding agencies, resident engineers or client representatives who oversee the project implementation, and contractors and the staff responsible for executing the works. These interviews are useful for getting an overall understanding of the project and gaining insights into the local context. The interviews should include open questions that aim to build a better understanding of a broader set of sector and employment related issues. These questions are also useful for assessing to what extent the different mechanisms for enhancing employment outcomes were used effectively. Samples of questions are provided in Box 1.

Procurement strategy: Is the procurement strategy allowing for or encouraging the use of local firms? Or small or medium enterprises? Does it include provisions for recruiting local labour?

▶ Box 1: Suggested topics and interview questions

Choice of technology: Does the project require the use of labour intensive methods? Were some materials or construction technologies specifically chosen to maximize or optimize the labour content?

Local content: Were any requirements for the purchasing local (community or national) in place. Where options existing, were locally produced materials chose over those imported) or to be transported from far?

Skills: Is it easy or difficult to find workers with the right skills and levels of experience? Did the contractor have to put in place specific measures to address this– on the job training, assigning more experienced workers to assist less experienced ones, additional supervision?

Quality and productivity: related to the question of skills, did managers have problems meeting quality requirements? Or productivity norms? Was this due to skills, or other issues? What constraints other than skills are there to improving quality and productivity?

Recruitment: What kind of recruitment processes were used? Where they effective? Did they use Ministries of Labour or Public Employment Services? Were there any efforts made to ensure levels of inclusivity in terms of youth, gender, or other groups?

Payment procedures and mechanisms: What was the basis for setting wages? Are workers paid based on time or tasks? How is the task system managed? Can workers earn more by doing more tasks? Are there any bonuses or extras? How often are workers paid? How- cash, bank transfers, others? Any specific challenges encountered in this regard?

Occupational Safety and Health: What measures are required in the contract? Are these in place? Are there clear procedures in place in case of an accident? What is nearest first aid post or hospital? Are there first aid supplies present on-site? Are records kept on the numbers and types of accidents? Are there sanitary facilities? Are there arrangements for child-care and breastfeeding?

Social security: What workers qualify/contribute to what types of social security measures (leave, health care, unemployment insurance, accident insurance, pension contributions). How is it determined who qualifies for what? Are there specific non-financial obstacles (bureaucratic, legal) that limit the extent to which social security benefits are provided?

Once the focus and types of questions have been determined, a semi-structured interview guide should be developed to be used during the meetings with the project stakeholders: contractor, sub-contractor(s), construction supervisor and project manager and clients.

Interviews should be recorded and transcribed, but to do this permission should be obtained beforehand[13].

The interviews should also be used to explain the data collection tools, the type of data as well as definitions used. They are also helpful to discuss local definitions which may be most appropriate such as for example how to categorize skills, what are conventions in terms of hours worked per day and days per week or month, and practices with regards to contract types, social security and the use of sub-contractors. The interview should also be used to identify persons who can assist with completing the data collection tools, if the interviewee is not able to do so.

One document of particular interest is the Bill of Quantities (BOQ) and this should be obtained. Ideally it should be the BOQ which was completed by the Contractor as part of his bid and is now part of the contract. The BOQ will assist in estimating the various inputs, including labour, required for completion of the project.

3.4 Data collection

Once the indicators are decided upon, the type of data to be collected to be able to calculate the indicators need to be determined. These should then be used to develop an appropriate data collection tool, typically a spreadsheet. The spreadsheet will contain space for all the data to be collected, and will also ideally automatically calculate the values of the various indicators. A sample of such a tool is provided in **Table 3.4**, and is also available electronically.

13 Transcription apps for mobile phones, such as Otter automatically transcribe (English) recordings which will make the interviewing recording and transcription process a lot easier and faster.

Table 3.4
Sample of a typical data collection tool (available electronically)

Job category	Job title	Number of non-youth workers		Number of youth workers (18-35)		Total person/ month	Employment type	Average Salary	Benefits	Min. Educational Level Required
01: Project managers 02:Engineers 03: Technicians 04: Skilled Labour 05: Unskilled Labour 06: Adminis-trative staff 07: Security guards 08: Cleaners 09: Other (specify the job title)						(worked until completion of construction for all workers in this job)	P: Permanent T: Temporary C: Casual/ daily	GHS/ Month	SS: Social Security PA: Paid Annual leave PS: Paid sick leave HI: Health insurance TA: Transportation provided or transportation allowance ML: Maternity Leave DC: Day care services CA: Child care allowance Other: specify	01: University (Bachelor's or above) 02:HND/ Diploma/post-secondary (qualifications midway between secondary and bachelor's, such as agriculture colleges or technical (construction) certificates from poly-technics, etc) 03: Secondary/ Technical/ Vocational / Commercial (includes SHS, GCE O&A Level, Technical schools, etc.) 04: BECE/MSLC 05: No education 06: Other specify
		Male	Female	Male	Female					
01	Project manager	1	0		35	20	P	1,200	SS, HI, TA	05
02	Quantity surveyor	1	0		35	20	P	1,200	SS, HI, TA	05
03	Site foreman	1	0		35	20	P	800	SS, HI, TA	06
04	Carpenters, masons, electrician, painters, plumber, steel binder, wilder, tiler	34	3		30	217	T	1,750	Covered by site all risk insurance	06
04	Machine operator	3	0		25	6	T	700	Site all risk insurance	08
05	Unskilled workers	55	10		23	351	C	1,250	Site all risk insurance	05
06	Store keeper	1	0		30	20	P	600	Site all risk insurance	06
06	Driver	1	0		30	20	P	600	Site all risk insurance	06
07	Security guard	1	2		30	20	P	300	Site all risk insurance	08
Totals		**98**	15							

3.5 Data analysis and expert assessments

Before completing the data analysis it is important to assess the quality of the data obtained, in particular that it is **accurate, consistent and complete**. It is also important to understand the granularity of the data obtained (See Box 2 on data quality for more details on the various dimensions of data quality). It is possible that employment data and information collected from different sources such as muster rolls or attendance registers, personnel and wage payment records or progress reports. In this case and it is important to check for consistency and potential double counting when combining data from these sources. Box 2 provides some guidance on assessing the quality of data obtained.

The data and findings should ideally be reviewed by someone familiar with the local construction sector to ensure that they are reasonable and credible. If there are concerns or doubts, these should be investigated further.

▶ Box 2: Key aspects of data quality

There are several approaches and methods to ensure and check the quality of data, and depending on the type of data different dimensions of data quality are important. For the studies related to this guide the following are deemed particularly relevant [14]:

Accuracy and Precision
This characteristic refers to the exactness of the data. It cannot have any erroneous elements and must convey the correct message without being misleading. This accuracy and precision have a component that relates to its intended use. Without understanding how the data will be consumed, ensuring accuracy and precision could be off-target or more costly than necessary. *For example, data on the dates of birth of all employees may not be available, and so it cannot be determined how many were youth. Estimations could be made, for example by surveying the current set of employees but this will not be as accurate and may not be acceptable if the main concern is youth unemployment.*

Reliability and Consistency:
Regardless of what source collected the data or where it resides, it cannot contradict a value residing in a different source or collected by a different system. There must be checks to ensure that the data is without contradiction or unwarranted variance. For example, a common problem with employment reporting is double counting. *For example an employee who switches contract may be counted twice, or a young woman may be I such a manner that she is reported as two jobs, once as a female employee and then again as a youth employee.*

Completeness and Comprehensiveness:
Incomplete data leads to a partial view of the overall picture to be displayed. It is important to understand the complete set of requirements that constitute a comprehensive set of data to determine whether or not the requirements are being fulfilled. *For example: the implications for not obtaining some data, like number of distinct employees should be understood, as it may compromise the study. This may need to be weighed against the (additional) costs of trying to obtain this information by going back to some data sources.*

Granularity and Uniqueness:
The level of detail at which data is collected is important, because confusion and inaccurate decisions can otherwise occur. Aggregated, summarized and manipulated collections of data could offer a different meaning than the data implied at a lower level. An appropriate level of granularity must be defined to provide sufficient uniqueness and distinctive properties to become visible. *For example: how detailed are wage payments, is the data obtained for each individual employee, or is what has been obtained aggregated? If it has been aggregated, is it possible to go back and verify it?*

14 These dimensions and descriptions were found to be particularly useful and were adapted from https://www.blazent.com/seven-characteristics-define-quality-data/

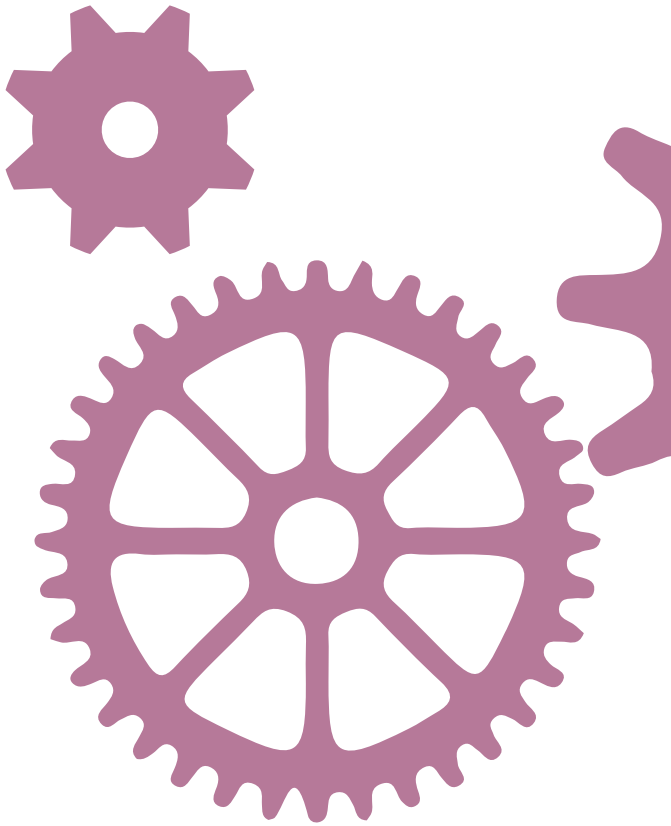
3.6 Reporting of results

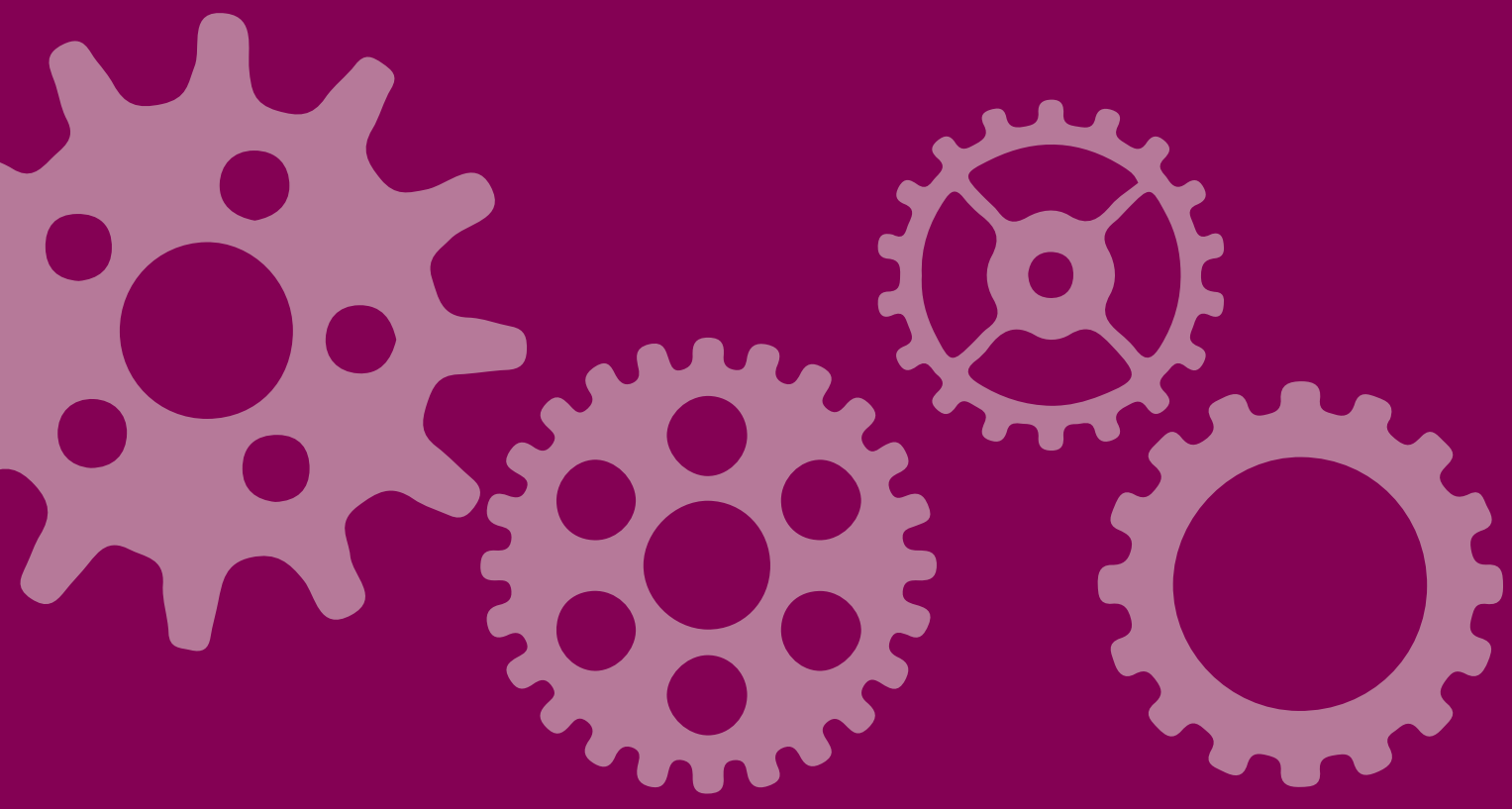
While there is no standard format for reporting results from a more detailed EmpIA, for consistency it is recommended that the report includes a summary of the key indicators presented in this guide. This would typically include all the indicators in **Table 2.7**, as well as those indicators in section 3.2 that were selected. Where data was not available, it is also recommended to indicate this clearly as this then makes it easier for the reader to avoid wasting time studying the report looking for such data.

In addition the findings from the interviews will also provide insights which will either help contextualize the findings from the data, or help explain some of the anomalies. It is therefore recommended that the findings of the interviews are synthesized, and where relevant quotes are included.

3.7 Project level data and information useful for macro estimations (indirect and induced effects)

Project level data on the various project inputs can be used to improve on estimations of the macro (indirect) employment impacts. It is efficient to collect this data as part of the same process of collecting the project or programme level employment data. This data pertains to the inputs (other than labour which is already captured) that are required, typically material inputs produced by other sectors of the economy, services provided by other sectors as well as factor capital inputs (profits). This can typically be obtained from financial records and project documentation, in particular the Bill of Quantities. The details on the type of information to collect and how to categorize it is explained in **Unit 4**.





Factory workers push a cart with bricks in kiln

▶ UNIT 4

Assessing indirect and induced employment effects of infrastructure investments using SAM Multiplier Analysis

4.1 Introduction

This unit shifts the focus from direct employment to the indirect and induced effects. As these effects occur mostly in other sectors of the economy and are more difficult to observe, estimating their magnitude requires a shift from a project or programme level focus, to a national or macroeconomic perspective. However there are important links between the project/ direct effects, and the macro/ indirect effects, and these will discussed briefly before presenting the methodology for assessing macro effects.

The methodology presented in this unit for assessing the indirect and induced effects is essentially a multiplier analysis using Leontief multipliers derived from an Input-Output Table (IOT) or Social Accounting Matrix. (SAM). This method also provides an estimate of the direct employment effects, not just of the indirect and induced. This direct effect will be based on national averages of the construction sector. Thus if the investment under consideration is very different from the national average, the direct effects from the multiplier analysis may differ greatly from those based on the project level data. The methodology presented aims to address this by using project level data in the macro analysis, to obtain more accurate and consistent estimates. They become more accurate by shifting from using construction sector averages to parameters that are more specific to the infrastructure investment in question. In order to do this, it is important to explain the similarities between the project level indicators and relevant macroeconomic indicators and this is done in the next section.

Before proceeding on this a few points are worth noting. Leontief multiplier based analysis is by no means the only method for assessing indirect and induced effects, and other methods exist or are being developed. The methodology presented in this unit and the accompanying annexes and references are not meant to be used by a project manager or staff involved in the project. It will typically require the involvement of a macroeconomist familiar with multiplier analysis. It is assumed that if a project want to do an assessment of its indirect and induced impact, a consultant with experience in using these methods will be contracted. This unit is meant to assist the project staff to develop a TOR for hiring such a consultant as well as interpret the results which will emerge from such a study. At the same it is also meant to provide guidance to the consultant, in particular if she or he has not done any assessments of infrastructure investments.

4.2 Links between the micro and macro effects and indicators

The specific and derived indicators presented in the previous Units were partially chosen because they are macro level equivalents. This allows the project level employment indicators to be compared with national figures. The core indicators and their macro/ national level equivalents are presented and discussed in **Table 4.1**.

Table 4.1
Core EmpIA indicators and their comparable macro level indicators

Information/Indicator	Comparable Macro economic indicator	Sources* and Observations
1. Number of persons employed broken down by gender, youth	**Total employment in the construction sector broken down by gender and youth**	This can be obtained from Labour Force Surveys, and if not available Household Surveys, or the census. Usually the figure for the construction sector is also available.
2. Number of hours of days worked broken down by gender, youth*	**Hours worked in the construction sector broken down by gender, youth**	This can be obtained from Labour Force Surveys. Usually hours worked for the construction sector are available.
3. Wages paid (broken down by gender, youth)*	**Total amount of wages paid in the in the construction sector**	Total wages paid can be obtained from national accounts. It is usually also available for the construction sector. Total wages paid can also be obtained from a SAM. This can be based on data from Labour Force Surveys, Establishment Surveys or Household Surveys.
4. Persons with disabilities broken down by gender and youth	**The total number of persons with a disability that worked on the project**	This may be available from labour force surveys.
5. Project expenditure*	**Total expenditure or output of the construction sector**	This can be obtained from the National Accounts or a Social Accounting Matrix. It can be obtained for the economy as a whole as well as the construction sector.
6. Labour Intensity (%)	**Labour share or factor labour (of the economy or the sector)**	The labour share for a sector can be obtained from the SAM or IOT. It is the share paid to labour (factor labour) for the sector divided by the total output of the sector.
7. Average project wage (Local currency per hour or day)	**Average wage (for the economy as well as the sector)**	This can be estimated by dividing the labour share by total employment. The labour share for a sector can be obtained from the SAM. Total employment in a sector (in hours or days) can be obtained from labour force survey data. Alternatively some LFS also provide average monthly earning reported by workers.
8. Average duration of employment (days or hours per worker)	**This is not usually reported separately**	If data on both hours worked and number of workers for a sector are available, this can be estimated but care needs to be taken to ensure that the period over which this is estimated is consistent with duration of the project.
9. Average total income per worker (local currency)	**Average income per employed person**	This is usually reported over an annual period but a project usually does not last exactly one year so the average project income would need to be annualized to make it comparable.
10. Total cost per day of work created (Local currency/ day of work)	**Output/employment ratio (Apparent productivity)**	This ratio commonly used in multiplier analysis to compute employment effects and employment multipliers.
11. FTE/ USD million	**Employment-output (EO) ratio for the sector**	This is commonly used for comparisons between countries, by converting local currencies to USD. This is the inverse of indicator 10, but expressed in USD.

* For many countries this information and data is available on the ILO's global employment database ILOSTAT, accessible on www.ilo.org/ilostat. In addition, a Social Accounting Matrix is constructed using various sources of national data and some of this information can also be found in the SAM.

The employment/output (EO) ratio (indicator 11), is an important indicator used in multiplier analysis to convert changes in output into changes in employment. Without this ratio, the multiplier analysis only provides estimates of how increased investment in infrastructure impacts overall output of the economy.

One specific advantage of having an EO ratio related to the construction of the specific type of infrastructure investment is that this can be used in the macro analysis presented in this unit. As the macro analysis also provides an estimate of direct employment, using this, instead of the average for the construction sector will provide more accurate estimates. This is one important way in which project of programme level data can be used to enhance the macro analysis.

4.3 Indirect and induced effects using multiplier analysis

The indirect and induced effects of an infrastructure investments can be estimated using Social Accounting Matrix (SAM) multiplier analysis. The infrastructure investment is treated as an exogenous shock to the economy, and the effects of the shock on the output of the economy is calculated using output multipliers. Output multipliers are expressed as numbers without units. For example the value of an output multiplier for the construction sector could 1.8, indicating that an increase in output of 1unit in the construction sector will lead to an increase of 1.8 units of the overall economy. Usually two types of multipliers are calculated, the Type I multipliers which capture the direct and indirect effects, and the Type II multipliers which capture direct, indirect and induced effects. This allows for assessing the indirect and induced effects separately which is important.

Once the change in output is estimated this and the EO ratios are then used to estimate the employment effect. The output multipliers and EO ratios can also be used to calculate employment multipliers. These are expressed as the number of jobs created for every additional amount of output (usually expressed in USD million).So if the employment multiplier for the construction sector is 31, it means that for every additional USD million of construction sector output 31 jobs are created in the entire economy. Again Type I and Type II employment multipliers can be calculated, depending on which output multiplier is used to calculate them. **Annex 4b** provides some values of these multipliers for different countries.

This methodology well established and documented in economic literature and described in detail in the **ETE Toolkit**. It will not be repeated in this guide and it is recommended that in the TOR for such work explicit reference is made to this Guide and the Toolkit. Unit 1 of the toolkit provides an overview of a Social Accounting Matrix which is useful for readers who may not be familiar with a SAM. Units 2 and 3 provide detailed steps of how to proceed and estimate the employment effects of such a shock.

The main points to take note of is that in the case of infrastructure investment,

- The value of exogenous shock would be based on the value of the infrastructure investment, but it needs to be "annualized" in that the amount of the investment that would be spend in a year needs to be estimated and this will be the value of the exogenous shock.
- The shock is then applied to the construction sector account of the SAM, or if the construction account is disaggregated to the most appropriate subsector. For example if the investment is in road infrastructure and the construction sector account is split into civil construction and building construction, the shock is best applied to the civil construction account.
- It should be noted that the results obtained will include the direct effects (jobs created directly by the project in the construction sector) as well as indirect and induced effects and will be the effect for one year.

If the SAM only contains an aggregated construction sector account, there may be good reasons to split the construction sector account to obtain a more accurate estimate. This is discussed in more detail in the next section.

It is also important to be aware of some of the well-known assumptions and limitations behind using IOT or SAM analysis to estimate the employment effects. Understanding these will assist in the interpretation and presentation of the results. The main assumptions and limitations to be aware of are:

- The completeness and accuracy of the underlying data used to compile the IOT or SAM. IOTs and SAMs are compiling from different data sets, and sometimes some can be out of date or certain assumptions are made during the compilation to address data gaps. So while they are meant to be objective representations of the economy this is not always the case.
- It is assumed there are no supply constraints and therefore increased demand leads to increased supply and not to higher prices.
- There are no increased economies of scale and production technology does not change, therefore one need 3 units of X to produce 1 unit of Y, it follows that we need 9 units of X to produce 3 units of Y.
- The sectors in the SAM represent a diverse set of activities that are aggregated, for example the construction sector includes both the construction of low-cost private housing as well as the construction major highways. Such aggregation can distort results.
- For estimating the induced effect, it is assumed that the consumption and savings patterns of households do not change if their income increases. However in general such patterns do change as household income increases. For very large investments this should ideally be taken into account[15].

Collectively, all these assumptions tend to lead to an overestimation of the employment effects. Despite these assumptions and limitations, multiplier analysis is widely used because of its simplicity and limited data requirements. As such it remains the most feasible approach to estimate indirect and induced effects. It should also be noted that other methodologies can be considered. These can either built on IOT and SAM based approaches, or be based on entirely different data sets[16].

15 This can be done by introducing a consumption function into the estimations. However this can increase the scope and costs of the assignment significantly.

16 See for example the Strengthen publications on different methodologies by Gibson and Flaherty (2017), Charpe (2019) and Shaffer (2019).

4.4 Refining estimates by creating a construction sector sub account

If it is thought that the inputs required and the labour content of the investment are deemed to be significantly different from the construction sector averages contained in the SAM construction sector account, it may be desirable to split the construction sector account and create a sub account based on the inputs and labour content of the infrastructure investment in question. To do this an initial comparison can be made. This can be done using estimates of the input and labour contents of the planned investment and comparing this with the technology coefficients in the construction sector of the SAM with those for the investment. This comparison can be done ex-ante with estimates of the inputs obtained from the project plan or detailed design (Bill of Quantities of the project), or using actual information if available from actual expenditure (See **Annex 4** for more details).

The comparison can be done by obtaining the technical coefficients for the construction sector account from the SAM (See Box 4), and comparing these to the inputs required for the infrastructure investment. Of particular relevance (and generally quite easy) is to compare the estimated labour intensity with the labour inputs in the SAM.

The other comparison is the estimated EO ratio of the project (expressed in FTE/ USD million), with the EO ratio of the construction sector which can be estimated from the construction sector account of the SAM and construction sector employment data (See Box 5).

If the differences are found to be substantial it is likely that the estimations will vary significantly as well. In this case a choice may be made to do a more accurate assessment. This would involve using the coefficients and EO ratios that more accurately reflect the investment in question.

The suggested approach for doing this is to split the construction sector account in the SAM into an account more reflective of the investment, and a “rest of construction” account. The account representing the investment would use the inputs, coefficients and EO ratios based on the data from the investment. The rest of construction account would be the residual. The rationale here is that the investment in question, for example construction of highways, is already included in the construction sector account, as this account reflects all construction sector activity in the economy. What is proposed is to disaggregate the account again and take the construction of highways back out of the construction sector account.

▶ Box 4: Determining the sector and labour inputs into the construction sector from a IOT or SAM

The construction sector inputs for an economy can be from the Construction sector account (Column) of the SAM. This account quantifies what inputs the sector purchases from other sector as well as from the factor accounts (labour and capital). This is illustrated in the table below. The first column contains all the sectors and factors the in SAM. The second column contains the spending by the construction sector on inputs from each of sectors and factors. These two columns can be obtained directly from the SAM. The third column presents the share of these inputs expressed in percentages and is calculated by dividing the inputs from each sector and factor by the total inputs purchased from the sector. These percentages are sometimes also referred to as the technical coefficients, as they are a reflection of the production technology used in the sector.

Table 4.2
Technical coefficients for the Construction Sector from a SAM for Rwanda

	Construction spending (RWF millions)	Percentage
Agriculture	0	0.00
Forestry	2,071	0.31
Textile and clothing	39	0.01
Wood, paper and printing	367,91	5.51
Chemicals	16,352	2.45
Non-metallic minerals	28,691	4.29
Furniture and other manu.	132	0.02
Electricity, gas and water	248	0.04
Construction	54,393	8.14
Wholesale and retail trade	9,294	1.39
Transports	77,061	11.54
Communication	12,002	1.80
Finance and insurance	64,357	9.63
Real estate	277	0.04
Business services	23,387	3.50
Repair	2291	0.34
Labour – unskilled	141,584	21.19
Labour - Low Skill	42,827	6.41
Labour - High Skill	7,652	1.15
Capital - Non-Agriculture	134,664	20.16
Capital - Sector Specific	13,913	2.08
Total	**668,027**	**100**

Source: (Lieuw-Kie-Song et. al. 2019)

So for example, according to this SAM the Construction sector spends 11.54 per cent of its expenditure of RWF 668,027 million on inputs from the transport sector. And the total labour intensity of the sector can be obtained from summing up the percentages of the three labour accounts. So total labour intensity is 21.19 + 6.41 + 1.15 = 28.75 per cent. These values can be compared with those estimated for the infrastructure investment under question to get a sense of how similar or different it is for the construction sector average. If these are quite similar, the multipliers for the construction sector can be used for employment estimations. However if they are very different, a separate account can be created to estimate the multiplier for the specific investment.

▶ Box 5: Determining the Employment Output ratios for the construction sector and the infrastructure investment

The EO ratio for the construction sector can be estimated by taking the total output of the construction sector, which can be obtained from the SAM and dividing it by total employment in the sector. This would typically be obtained from Labour Force Survey data. This can be compared to the EO ratio for the investment which can be estimated from the total budget divided by the total anticipated direct employment.

It is important of course that the same units are used. From the SAM, the output for the construction sector would usually be obtained in millions of local currency units. And for the employment data, it is recommended that employment in the sector is estimated in FTEs. This can be calculated from data on total hours worked in the sector. So in the case of Rwanda, total output of the construction sector as presented in Box 4 is RWF 668,027 million. Total employment in the construction sector was estimated at 211,650 FTEs. The Employment to Output ratio is thus 211,650 FTE/ RWF 668,027 million = 0.316 FTE/ RWF million. This can be converted into FTE/ USD million using the appropriate exchange rate. This figure can also be inversed and expressed in USD/ FTE, which is the Output to Employment Ratio. As explained earlier these figures are comparable with indicators 10 and 11 in the Table 4.1.

Additional background to this methodology as well as the steps of how to apply it are explained in **Annex 3** of this Guide. This Annex is structured to be used together with the Assessing the effects of Trade on Employment: An Assessment Toolkit and can be used together with Units 2 and 3.

As is also explained in **Annex 3**, some difficulties can be encountered when applying this methodology to a specific case. These will arise when there is no updated IOT or SAM available for the year of the specific case to be considered. It may also arise when the IOT or SAM is not very detailed and specifically the inputs for the construction sector are limited. For example, some sectors are not providing inputs into the construction sector according to the SAM, although in reality one would expect this to be the case. This is due to the fact that the SAM is itself composed of various data sets and so also represents the best estimation of the circular flow of the economy based on available data. Working with these limitations will thus require good judgment on the side of those conducting the assessment as well as sensitivity analysis to check how much the results change when different assumptions are made to address these data shortcomings. It is therefore recommended that the assessments are conducted jointly by experienced economists familiar with IOT and SAM analysis as well as professionals who know the construction sector so that reasonable assumptions are made along the way.

4.5 Analysis of results and reporting on the indirect and induced employment effects

The results obtained from applying the methodology as outlined in **Annex 3** can be presented in different ways. At a more global level these results can presented as the total number of direct, indirect and induced FTEs that will be generated through the infrastructure investment. In the case of an ex-ante assessment where just a global estimate of the employment effects are of interest this may be sufficient.

Table 4.3
Estimated employment effects from Feeder Road investments in Rwanda

Sectors	Increase in total hours worked Feeder Roads	Increase in total hours worked Feeder Roads LB
Forestry	462,952	507,754
Fishing & Hunting	273,789	301,168
Textile Manufacture	962,172	1,009,108
Wood and Paper Products Manu.	1,577,024	1,823,434
Chemical Industries	807,386	886,027
Non-metallic Products.	366,573	185,568
Furniture and other Manu.	–	–
Gas, Water & Electricity	400,416	369,615
Construction	6,083,589	33,912,176
Wholesale and Retail Trade	4,200,704	3,543,610
Hotel & restaurants	518,758	492,820
Transport	3,558,160	4,474,806
Communications	146,382	131,744
Financial services	667,547	712,349
Real Estate	22,125	18,871
Business Services and repair	445,267	354,485
Total non-construction	14,409,256	14,811,358
Total	**20,492,844**	**48,723,535**

Source: (Lieuw-Kie-Song et. al. 2019)

However, it is also possible to present disaggregated effects, showing in which of the sectors the indirect and induced employment effects will be generated as shown in **Table 4.3**. This show the results for two options, the construction of feeder roads using more capital intensive of more LI methods. It shows the effects broken down per sector, as well as the totals. This may be important as there may be a particular interest in showing how the construction sector is linked to other sectors, and thus how increasing output in this sector, impacts on other sectors in the economy. This will require that the multipliers are disaggregated for each sector, and that the EO ratio for each of the sector is estimated. This can also be done if one wants to be more conservative when presenting the results and take into account some of the limitations of the methodology which can lead to overestimations. For this reason the effects on employment in agriculture were not included[17]. **Annex 3** also contains another example of reporting results.

In particular in developing countries, with a high shares of agricultural and informal employment, care should be taken in this regard. Because these have such low productivity (and high employment-output ratios), the analysis tends to overestimate employment effects for these sectors. Consideration can therefore be given to not including effects in the agriculture and sectors with very high level of informality and employment output ratios in the results.

17 This was also done as the Rwandan government was explicitly interested on effects on non-agricultural employment.

Finally, it is important that any discussions on the results are had taking into account the assumptions and limitations of using SAM multiplier analysis and which were presented in Section 4.3. It should be noted that some of these assumptions and limitations can also be used to raise important policy questions and inform policy and social dialogue. Some suggestions of how these be turned into policy questions are presented in **Table 4.4**.

Table 4.4
Assumption in Multiplier Analysis and related policy questions

	Assumption/ Limitation	Related policy questions
1.	No supply constraints and fixed prices	Is this a reasonable assumption? Are stakeholders aware of sectors that are already facing supply constraints? Would these constraints more likely result in higher prices? Should measures be considered to address these constraints? *Example: If local cement production is already operating and full capacity, increased construction demand is not likely to results increased output and employment in this sector. Rather it may lead to either increased prices or increased imports and lower employment effects.*
2.	No economies of scale and constant production technology	Is it correct that the production technologies of the relevant sectors will remain the same? Or would increased demand result in investments that would change the production technology? Is this process already underway in the sector? *Example: In an economy where brick manufacturing is done through both small-scale large-scale mechanized producers, there may exist large economies of scale it may be possible to increase output without hiring additional workers in the same proportion and this would results in lower employment effects.*
3.	Aggregation and nature of the sector	As with the construction sector, other sectors of a SAM also contain a very wide range of activities with very different production technologies and input structures. This will require careful interpretation of the result for these sectors and a discussion on which types of firms in these sectors would be likely to increase their output. *Example wholesale and retail may contain wholesalers with sophisticated warehousing and distributions centers, as well as informal street vendors, but a large construction project is more likely to buy its inputs from a large wholesaler. This would this result in increased formal employment with wholesalers, but little increase in informal employment in this sector.*

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▶ Annexes

Annex 1. Template for Regular Progress Reporting*

Note: Report is cumulative reflecting figures from start of the project	Reporting period: 1 June 2018 to 1 Oct 2019	
Indicator	**Value**	
1. Employment generated (days)	**Total** **% to female** **% to youth**	**14 000** 29% 57%
2. Wages paid (USD or local currency)	**Total** **% to female** **% to youth**	**153 000** 22% 49%
3. Project expenditure (USD or local currency)		**250 000**
4. Labour intensity (To date), %		**61%**
5. Average project wage (To date) (in USD or local currency)	**Global** **Average for women** **Average for men** **Average for youth** **Average for non-youth**	**10.93** 8.25 12.00 9.38 **13.00**
6. Cost per day of work created (USD/ day)		17.86
7. Days of work generated per million (Days/USD or local currency million)		**56 000**

* An electronic version of this Annex can be downloaded here or from www.ilo.org/eiip

Annex 2.
Template for Project Completion Report*

Note: Report is cumulative reflecting figures from start of the project	Reporting period: 1 June 2018 to 31 Dec 2019	
Indicator	**Value**	
1. Employment generated (FTE)	**Total** **% to male** **% to female** **% to youth** **% to non-youth** **(1FTE= 230 days)**	**163** 68% 32% 48% 52%
2. Number of persons employed	**Total** **% to male** **% to female** **% to youth** **% to non-youth**	**390** 72% 28% 54% 46%
3. Wages paid (USD)	**Total** **% to male** **% to female** **% to youth** **% to non-youth**	**365 000** 70% 30% 45% 55%
4. Project expenditure (FINAL) (USD)		**900 000**
5. Labour intensity (FINAL), %		**41%**
6. Average project wage (USD/day)	**Global** **Average for women** **Average for men** **Average for youth** **Average for non-youth**	**9.73** 10.00 9.17 9.17 10.26
7. Average duration of employment (days)	**Global** **Average for women** **Average for men** **Average for youth** **Average for non-youth**	**96** 91 109 86 108
8. Average income per worker (USD/worker)	**Global** **Average for women** **Average for men** **Average for youth** **Average for non-youth**	**936** 911 1 000 786 1 111
9. Cost per FTE created (USD/ FTE)		**5 520**
10. FTEs generated per million (FTE/ USD million		**181**

* An electronic version of this Annex can be downloaded here or from www.ilo.org/eiip

Annex 3. Methodology for disaggregating the construction sector account

This Annex is complementary to Unit 4 of this Guide. It also refers to Units 2 and 3 of the Assessing the effects of Trade on Employment: An Assessment Toolkit, which is another Strengthen Project publication and can be accessed here.

A3.1 An overview of the approach

Much of the existing **social accounting matrix (SAM)** based guidance on measuring employment effects are not specific to a particular type of infrastructure investment. In this context, the employment effects of infrastructure investments are assessed using employment multipliers which are computed using the construction account of the SAM and the Employment Output ratios for the economy. While there are already well documented limitations in using this approach estimate employment effects, in the case of specific infrastructure investments, this approach has further limitations. These limitations are mainly associated with the fact that the key parameters that influence the employment estimates of such specific investments, namely the **value and composition of the multiplier** and the **employment-output ratio**, may differ significantly from the values obtained when using construction sector averages. The proposed approach is an adjustment to the existing SAM based methodology and allows for deriving multipliers and employment output ratios that reflect the particular characteristics of the infrastructure investment in question.

In a nutshell, the approach involves creating a sub account for the infrastructure investment under study as a subaccount of the construction sector of the SAM. The construction account of the SAM is split into two accounts: **a sub account** reflecting the characteristics of the investment in questions and rest of **construction sector** which contains the remaining activities of the sector. Once the sub account is created in the SAM, the multipliers of the sub account can be computed using the conventional SAM multiplier analysis. It is a relatively simple method meant to improve estimates when using a SAM. It is used because of its relative simplicity and can be done when a recent SAM and employment data is available. It remains an estimation- and the results should be interpreted as such. All the assumptions and limitations of doing such a multiplier analysis as presented in Unit 4 still apply.

Tables A3.1 (a&b) presents an overview of the disaggregated SAM which we will use to analyze the employment effects of infrastructure investment. **Table A3.1 (a)** presents how the inputs of the infrastructure project are inserted into the SAM. This is done be adding a column as highlighted in grey. **Table A3.1(b)** shows how the outputs of the project are integrated be adding a row.

Table A3.1(a)
Creating the infrastructure project sub-account: inserting inputs

	Sector 1	Sector 2	-	-	Construction (Y)	Sub-Account (infrastructure Investment) (X)	-	Sector n	Factors	-	Total
Sector 1	-	-	-	-	Y1-X1	X1	-	-	-	-	Row Sum
Sector 2	-	-	-	-	Y2-X2	X2	-	-	-	-	Row Sum
Sector 3	-	-	-	-	Y3-X3	X3	-	-	-	-	Row Sum
Sector 4	-	-	-	-	Y4-X4	X4	-	-	-	-	Row Sum
-	-	-	-	-	-	-	-	-	-	-	Row Sum
-	-	-	-	-	-	-	-	-	-	-	Row Sum
Sector n	-	-	-	-	Yn-Xn	Xn	-	-	-	-	Row Sum
Factors	-	-	-	-	Yf-Xf	Xf	-	-	-	-	Row Sum
-	-	-	-	-	-	-	-	-	-	-	Row Sum
Total	-	-	-	-	Coulumn sum	Coulumn sum	-	-	-	-	

At this stage, it is important to recall two essential features of a SAM: first, as it represents transactions and transfers in an economy, all entries in the SAM are in monetary values and, second, each column elements of the SAM represent the value of intermediate material and factor inputs that sectors purchase form other sectors of the SAM in the production process. In **Table 3.1(a)**, Y (represented by Y1, Y2.... Yn) is the input vector, represents the inputs which construction sector purchases from other sectors of the SAM. X is the input vector for the inputs the infrastructure investment under study purchases from other sectors. n represents the number of sectors that are included in the SAM, and f represents the factor inputs used by sectors. While the inputs of construction sector Y are already available in the SAM, the input values of the infrastructure investment (X) need to be determined and this is explained further below.

Once the material and factor input data of the project have been collected, the inputs are matched with the sectors in the SAM and inserted into the subaccount. Then, the inputs of the sub-account should be subtracted from the inputs of the construction sector as indicated in **Table A3.1 (a)** in the form of Y1-X1, Y2-X2... Yn-Xn. This ensures that the SAM remains balanced. (Note that adding back together the inputs of the construction sector (Y1-X1, Y2-X2... Yn-Xn) and the inputs of the infrastructure project (X1, X2... Xn) should result in the original construction sector input structure.

Table A3.1 (b) shows how the outputs of the infrastructure investment under study is to be integrated into the SAM. As noted in the previous units, the row elements of the SAM represent the intermediate sales of output to other sectors.

Table A3.1(b)
Creating the infrastructure project sub-account: inserting outputs

	Sector 1	Sector 2	-	-	Sector n	Factors	-	SI	-	Total
Sector 1	-	-	-	-	-	-	-	-	-	Row Sum
-	-	-	-	-	-	-	-	-	-	Row Sum
-	-	-	-	-	-	-	-	-	-	Row Sum
-	O1-A1	O2-A2	-	-	On-An	Of-Af	-	Osi-Asi	-	Row Sum
-	-	-	-	-	-	-	-	-	-	Row Sum
-	-	-	-	-	-	-	-	-	-	Row Sum
Sub account (Infrastructure Investment)	A1	A2	-	-	An	Af	-	Asi	-	Row Sum
-	-	-	-	-	-	-	-	-	-	-
Sector n	-	-	-	-	-	-	-	-	-	Row Sum
Total	-	-	-	-	-	-	-	-	-	

SI= saving and investment

In Table A3.1(b), ***A*** represents the output of the infrastructure investment which in most cases can be assumed to be equivalent the total budget spent on the project in the year of the SAM. ***O*** represents the output of the construction sector, ***n*** represents the number of sectors in the SAM, and f represents the output from factors. Once the output of the infrastructure sector is determined, it should be inserted into the SAM as indicated in the table. And like to the inputs, the outputs of the infrastructure project should be subtracted from the output of the construction sector. In the case of public infrastructure, the output is a public good and so does not serve an input to other sectors. The output is therefore allocated to the savings and investment account of the SAM.

Now, the SAM is adjusted and the construction sector is split in a way that distinguishes between the infrastructure investment and the rest of construction sector activities. Using this adjusted SAM, we can compute the multipliers for the infrastructure investment following the steps that the ETE toolkit presents in Unit 2. Thus the Type I and Type II output multipliers can be computed and these along with the employment-output ratios can in turn be used to compute the employment multipliers. The employment multipliers can then be used to estimated the employment effects of the investment.

A3.2. Example: Assessing the employment effects of social housing projects in Ghana

To practically demonstrate the method, we will now present an example from Ghana where the employment effects of **social housing construction projects** funded by the Ghanaian government were assessed (Full report available here). The assessment was done in five steps:

Step 1: Collect the material and factor input data of the social housing projects for which the employment impact assessment is conducted

Step 2: Match the material and factor input data of social housing with the sectors in the SAM

Step 3: Create social housing sub-accounts in the SAM

Step 4: Compute Type II and Type I multipliers of the social housing

Step 5: Estimate the indirect and induced employment effects of social housing investment.

Each step is discussed in more detail below.

Step 1: Collecting material and factor input data of social housing

The data was obtained from a social housing project that was considered typical and large enough to be representative of the Ghanaian government's social housing investments. The project consisted of three building types, consisting of 8, 16 and 24 units respectively. In total the project comprised of 24 buildings with a total of 280 apartments (units). In addition to detailed data on the quantity and price of material and labour input of the projects, information on the sources of the inputs was also collected. This was done to differentiate between the imported inputs and locally produced ones.

The material and labour inputs data obtained from the social housing project is presented in **Table A3.2**. This figures are based on the original Bill of Quantities as well as actual expenditure to date. As the project was still ongoing, it was not possible to obtain final expenditure and so the totals were projected based on the BOQ and expenditure to date.

Table A3.2
Cost breakdown of the material and labour inputs of social housing

	Building type			Material source	Total for all buildings (USD[1])
	8 units	16 units	24 units		
Breakdown of construction value in USD1 based on BoQ for each building type					
Materials	**178,142**	**365,005**	**432,772**		**5,854,517**
Cement, sand and stones related products	52,479	116,295	120,886	Local	1,724,572
Timber products	41,818	80,103	89,327	Local	1,308,523
Steel products	26,809	55,445	85,832	Local	965,416
Glass products	2,425	4,850	4,989	Local	75,731
Ceramic related products	10,461	20,908	30,854	Imported	363,977
PVC related products	3,657	7,250	9,812	Local	123,167
Paint	8,314	15,795	16,415	Local	254,383
Electrical accessories, cablings, fittings, consumer units, control gears and power lighting systems	32,179	64,359	74,656	Local	1,038,744
Labour	95,281	196,768	223,422		3,103,769
Equipment	12,389	20,917	19,308		350,596
All risk insurance	1,471	2,993	3,425		47,686
Performance bond	1,586	3,115	3,494		50,283
Water	1,609	4,505	4,827		60,176
Project management[2]	9,976	11,939	14,545		263,589
Health and safety	1,931	4,988	9,654		86,407
Transportation	9,847	20,401	23,619		323,078
				Construction value in USD[1] for all buildings (A)	10,140,101
				Supervision costs in USD[1] for all buildings (B)	528,479
				Total project cost (A+B)	**10,668,580**

1. Using the average exchange rate of 2017 (1 USD=4.3506 GHS).
2. Includes site office maintenance, progress photographs, and other associated expenses.

Source: Abbadi et. Al. 2019

Step 2: Matching data to sector and factor accounts of the SAM

The material and labour inputs data of the projects as collected by the survey should then be matched to the SAM sectors in order to be able to insert the inputs into the SAM. This has to be done using the International Standard Industrial Classification (ISIC) guidance and in consultation with local experts. In principle, the inputs which social housing buys should be matched with and subtracted from the inputs that the construction sector buys in the SAM. This is with the assumption that social housing investments are already included in the construction sector of the SAM. **Table A3.3** presents the SAM sectors which provide inputs to the construction sector. The total input spending of the construction sector is 28.3 billion GHS which is distributed among nine sectors that provide material inputs to the construction sector and the two factor accounts: labour and capital.

Table A3.3
Sectors and factors providing inputs to the construction sector in the SAM

Description	Codes in the SAM			Construction	
Mining	comin	-	-	332	-
Wood and paper	cwood	-	-	1529	-
Petroleum	cpetr	-	-	158	-
Chemicals	cchem	-	-	307	-
Non-metal minerals	cnmet	-	-	1,849	-
Metals and metal products	cmetl	-	-	3,292	-
Machinery and equipment	cmach	-	-	173	-
Construction	ccons	-	-	25	-
Transportation and storage	ctran	-	-	23	-
Labour	flab	-	-	2,584	-
Capital	fcap-n	-	-	18,097	
Total				**28,369.55**	

Source: 2015 Ghana SAM

The inputs of social housing were then matched with the sectors which provide inputs to the construction sector. This is presented in **Table A3.4** below. The last column of the table shows how the inputs of social housing were matched with the sectors in the 2015 SAM of Ghana. As indicated, material inputs such as cement, sand, stone and related products were allocated into **non-metal minerals** account of the SAM. Steel products and electronic accessories allocated in **metal and metal related products** account, timber products were also allocated into **wood and paper products** account of the SAM. Paints were also allocated to the chemicals sector.

It should be noted that allocating the inputs of the infrastructure investment into the sectors in the SAM is not always straightforward. One difficulty is that it may be found that infrastructure investment buys inputs a sectors that the construction sector in the SAM does not. For instance, in this example, it was found that social housing buys inputs that should be allocated to sectors such as financial services and water supply and sewage. However, the construction account is the SAM does not buy inputs from these sectors, so allocating the inputs to those sectors would unbalance the SAM.

There are several options to address this and this will require some judgment on the side of those conducing the assessment. One is to consult with the institution which constructed the SAM on how the inputs should best be matched. If the input spending of the infrastructure investment on those sectors is not very large and will not to distort the result the analysis, it

may also be decided not to include them. Another option is to allocate them to another sector that is closely related[18].

Looking at the factor inputs, the labour cost of the project was allocated into the labour account of the SAM. It is important to mention that in many SAMs the labour account is disaggregated by locality and skills level of workers. Thus, when the input data is collected for the infrastructure projects, the survey tools should be structured in such a way which allows the labour inputs to be allocated to the labour categories of the SAM. However, if such a breakdown of labour data is unavailable from projects, the labour categories in the SAM can be aggregated into a single labour account. Any profits should be allocated to the factor capital account of the SAM.

A final note is to made with regards to the exchange rates and dates for the SAM. While the project was implemented over 2017, the SAM is for 2015 and no SAM was available for 2017. As the structure of the economy, and in particular the proportion of the various inputs, would not have changed much over this period, we expect the multipliers not to have changed much either. However the exchange rate in 2015 was 3.75, significantly lower than the rate of 4.36 of 2017. As no SAM is available for 2017, it was decided to use the 2015 exchange rate to simulate the investment and so the investment of USD 10,668 was converted into GHS at this rate.

Table A3.4
Matching the social housing input with the sectors in the SAM

Material and Labour inputs	Input cost for all buildings (USD)	Input cost for all buildings (GHS)	Input cost for all buildings (in millions of GHS)*	Best fitting sector in the SAM
Cement, sand and stones related products	1,724,572	6,467,145	6.47	Non-metal minerals
Timber products	1,308,523	4,906,961	4.91	Wood and paper
Steel products	965,416	3,620,310	3.62	Metals and metal products
Glass products	75,731	283,991	0.28	Non-metal minerals
Ceramic related products	363,977	1,364,914	1.36	Non-metal minerals
PVC related products (Imported)	123,167	461,876	0.46	Non-metal minerals
Paint	254,383	953,936	0.95	Chemicals and petroleum
Electrical accessories,	1,038,744	3,895,290	3.90	Metals and metal products
Labour	3,103,769	11,639,134	11.64	Labour account
Equipment	350,596	1,314,735	1.31	Machinery and equipment
All risk insurance	47,686	178,823	0.18	Finance and insurance
Performance bond	50,283	188,561	0.19	Finance and insurance
Water	60,176	225,660	0.23	Water supply and sewage
Project management	263,589	988,459	0.99	Construction
Health and safety equipment	86,407	324,026	0.32	Machinery and equipment
Transportation	323,078	1,211,543	1.21	Transportation and storage
Project management (Supervision) costs in USD for all buildings (B)	528,479	1,981,796	1.98	Construction
Total	**10,668,576**	**40,007,160**	**40.01**	

* **The 2015 Ghana SAM is in millions of GHS and the inputs costs of social housing were also converted accordingly at the 2015 exchange rate of GHS 3.75 per USD.**
Source: Abbadi et. al. 2019

18 Another option would be to include all the sectors and update and rebalance the SAM. This can be quite an elaborate exercise however and may significantly increase the scope and expertise required to conduct the assignment.

Step 3: Inserting the allocated inputs and output data of social housing into the SAM

Once the social housing inputs are collected and matched with the sectors in the SAM, the next step is inserting the input costs into the SAM. To do so, first, the input costs collected from the projects should be converted to the currency and unit used in the SAM. Transactions in the 2015 Ghana SAM are presented in millions of GHS, so the inputs of social housing should be converted accordingly.

Social housing sub-account was subsequently created in the SAM as indicated in **Table 3.5**. The material and labour inputs of social housing were inserted according to the sectors they were allocated to, and the inputs were subtracted from the input costs of the construction sector. For example, the construction sector purchases GHS 1,529 million worth of inputs from wood and paper and the amount that social housing projects buy from the same sector is estimated to be GHS 4.9 million GHS, so this 4.9 million was subtracted from what construction sector spends on this sector. The same was done for all sectors from which the construction sector and social housing purchase their inputs including labour inputs.

Table A3.5
Creating the new social housing subaccount and inserting the inputs costs

Description	Codes in the SAM	Electricity	Water supply	Construction	Social housing	Wholesale trade
Mining	comin	-	-	331.60	-	-
Wood and paper	cwood	-	-	1,524.30	4.91	-
Petroleum	cpetr	-	-	157.90	-	-
Chemicals	cchem	-	-	306.00	0.95	-
Non-metal minerals	cnmet	-	-	1,840.50	9.03	-
Metals and metal products	cmetl	-	-	3,284.90	7.50	-
Machinery and equipment	cmach	-	-	171.80	1.63	-
Construction	ccons	-	-	22.10	2.99	-
Transportation and storage	ctran	-	-	21.49	1.21	-
Labour	flab	-	-	2,572.50	11.64	-
Capital	fcap-n	-	-	18,097.20	-	-
Total		**-**	**-**	**28,330.19**	**39.51**	**-**

Inserting the outputs of social housing into the SAM

The outputs of the social housing were allocated to the saving and investment (S-I) account of the SAM. **Table A3.6 (a)** presents the output of construction which is allocated into the Savings and Investment (S-I) account of the current SAM. GHS 26.3 billion or 93 percent of the output of construction is allocated into the S-I account of the SAM. **Table A4.6 (b)**, shows how the output of social housing was included into the SAM. All the output of social housing was allocated into the S-I account and the same amount was subtracted from the construction output allocated to the same account.

Table A3.6 (a)
The output of the construction sector allocated to saving and investment

Description	mtax	stax	s-i	dstk	row	total
Water supply	-	-	-	-	-	-
Construction	-	-	26,394	-	-	28,370
Wholesale trade	-	-	-	-	-	-

Source: The 2015 Ghana SAM

Table A3.6 (b)
Creating the new social housing subaccount and inserting outputs

Description	mtax	stax	s-i	dstk	row	total
Water supply	-	-	-	-	-	-
Construction	-	-	26,356	-	-	28,330
Social housing	-	-	39.51	-	-	39.51
Wholesale trade	-	-	-	-	-	-

Step 4: Computing Type I and Type II multipliers of the social housing

Once the inputs and outputs are integrated into the SAM, the next step is computing the **Type I and Type II output multipliers** of social housing using this amended SAM. Type I multipliers only capture the direct and indirect effects and the Type II output multipliers capture the direct, indirect and induced effects. From this it also follows that the difference between the two multipliers captures the induced effect. The method to derive these multipliers is well established and can be summarised as follows:

- **1. Compute the technical coefficient (A matrix) of the SAM.**
  To derive the A matrix, the values of each sector of the SAM should be divided by the total sum of that column.
- **2. Create an identity matrix (the I matrix).**
  The identity matrix of the SAM has ones on its main diagonal elements and zeros elsewhere.
- **3. Subtract the A matrix from the identity matrix (I–A).**
- **4. Derive matrix of multipliers.**
  The SAM multiplier matrix is the inverse of the **(I–A)** matrix.
  Which is represented by **(I–A)** –1

A detailed explanation of all the steps for deriving these multipliers presented in Unit 2 of the ETE toolkit but is also widely available in literature of IOT and SAM[19].

19 The method for calculating these multipliers, was developed by W. Leontief for which he won the Nobel Prize in 1973 and remains widely used. Other references explaining the method are XXXX (Text book) which also explains the theory behind the method and *Social accounting matrices and multiplier analysis* (IFPRI 2009) which provides more practical guidance much like the ETE Toolkit.

▶ Box A1: Description of multipliers

The **multiplier** refers to an economic concept that shows how much or by how many times the final output of a given sector would increase if some extra investment/spending is done in other sectors. It also provides an indication of how an increase in one area, leads to increases in other areas.

Input-output (Type I) multipliers are computed from the intermediated demand table of the SAM and capture the direct and indirect production effects only. They estimate the impact on the supply chain resulting from a producer of a certain product increasing their output to meet additional demand. However, Type I multipliers underestimate the effect on the economy as they do not estimate the induced effects.

SAM multipliers (Type II) are calculated using the entire SAM and in addition to the direct and indirect effects, they include the induced effects based on how households spend the income they earn from the direct and indirect effects. Multipliers computed using the SAM are, therefore, tend to be larger than multipliers computed using the input-output table.

The first step to compute multipliers is deriving the technical coefficients (matrix A) of the sectors in the SAM including the newly integrated social housing subsector. Technical coefficients (Matrix A) show the proportional value of inputs purchased by a given sector to produce one unit of output in that sector. And each entry in the matrix A is calculated by dividing the corresponding cell of the SAM by its column total.

Note that when deriving the technical coefficient (matrix A), it is important to identify the **endogenous accounts and exogenous accounts** of the SAM. In most SAM framework, it has been customary to regard transactions in **the government account, tax, the saving and investment account, and the rest of the world** as exogenous accounts. Thus, all values in these accounts of the Ghana SAM were made exogenous. In excel, we can make account exogenous by simply inserting zero in all cells of the matrix A of these accounts as indicated in **Table A3.7**. **Table A3.7** presents the technical coefficients (matrix A) of social housing and for comparison, the matrix A of the construction sector is also presented.

Table A3.7
The technical coefficient of social housing and construction sector

Description	Endogenous accounts				Exogenous accounts					
	-	Construc-ction	Social housing	-	gov	mtax	stax	s-i	dstk	row
Mining	-	0.012	0	-	0	0	0	0	0	0
Wood and paper	-	0.054	0.128	-	0	0	0	0	0	0
Petroleum	-	0.006	0	-	0	0	0	0	0	0
Chemicals	-	0.011	0.025	-	0	0	0	0	0	0
Non-metal minerals	-	0.065	0.224	-	0	0	0	0	0	0
Metals and metal products	-	0.116	0.197	-	0	0	0	0	0	0
Machinery and equipment	-	0.006	0.043	-	0	0	0	0	0	0
Construction		0.001	0.078	-	0	0	0	0	0	0
Transportation and storage	-	0.001	0	-	0	0	0	0	0	0
Labour	-	0.091	0.305	-	0	0	0	0	0	0
Capital	-	0.639	0	-	0	0	0	0	0	0
Total	**1**	**1**	**1**	1	**0**	**0**	**0**	**0**	**0**	**0**

Source: computed by authors

The technical coefficients of social housing presented can be interpreted as follows: out of every 1 GHS spent by social housing sector on the inputs, 12 percent of the inputs spending will be on **wood and paper products**; 22 percent will be spent on non-metal minerals; 19 percent on the **metals and metal products**. Social housing spends a significant amount its of inputs cost on labour which is around 30 percent of its total input spending.

There is a significant difference in the input spending pattern of the construction sector as a whole compared to what was found for social housing alone. For instance, while the construction sector spends only 7 and 5 percent of its input expenditure on **non-metal minerals** and **wood products** respectively, whereas social housing spends 22 and 12 percent of its input spending on non-metal minerals and wood products respectively. Looking at the factor inputs, while the construction sector spends 9 percent of its input spending on labour inputs, social housing spends 30 percent of its input spending on labour.

The biggest difference is that the SAM also shows 63 percent of construction spending is allocated to the factor capital inputs. This seems very high, and probably reflects a common practice in the construction of SAMs of allocating the residual output of the sector to the capital account[20]. These factor payments theoretically represent profit share, purchases of land by the construction sector, as well as the cost of capital associated with the high-interest rates in Ghana. For the social housing, the building was done on government land which was thus free to government. from the data collected for the project, the profit margins appeared very low and were assumed to be zero[21].

The resulting Type I and Type II multipliers for social housing and the construction sector are presented in **Table A3.8**.

20 It also demonstrates one limitation of using the SAM in contexts where these are constructed on the basis of limited data sets.

21 As the project was still ongoing and the data provided by the contractor on this was limited the profit margin could not be deducted. Because of some delays encountered and what to the assessment team seemed to have been an underestimation of the labour costs, there were strong indications that the contract would be making a loss on the project. For these reasons the profit margin was taken to be zero.

Table A3.8
Type I and Type II multipliers of social housing and the construction sector

	Social Housing		Construction	
Sectors	Type II Multipliers	Type I Multipliers	Type II Multipliers	Type I Multipliers
Agriculture, forestry and fishing	0.23	0.12	0.23	0.05
Mining and quarrying	0.05	0.09	0.06	0.05
Agro-processing	0.14	0.01	0.17	0.00
Textile and clothing	0.04	0.00	0.05	0.00
Wood and paper	0.15	0.17	0.07	0.07
Petroleum and Chemicals	0.16	0.18	0.16	0.09
Non-metal minerals	0.27	0.39	0.08	0.11
Metals and metal products	0.23	0.33	0.14	0.18
Machinery and equipment	0.10	0.10	0.08	0.03
Other manufacturing	0.01	0.01	0.02	0.01
Electricity, gas and steam	0.05	0.05	0.06	0.02
Water supply and sewage	0.03	0.00	0.04	0.00
Social housing	**1.00**	**1.00**	-	-
Construction	0.08	0.08	1.00	1.00
Wholesale and retail trade	0.13	0.01	0.12	0.01
Transportation and storage	0.15	0.02	0.15	0.01
Accommodation and food services	0.07	0.00	0.09	0.00
Information and communication	0.04	0.01	0.05	0.00
Finance and insurance	0.04	0.02	0.04	0.01
Real estate activities	0.03	0.01	0.03	0.00
Business services	0.03	0.03	0.04	0.02
Public administration	0.01	0.00	0.01	0.00
Education	0.03	0.00	0.04	0.00
Health and social work	0.01	0.00	0.01	0.00
Other services	0.05	0.00	0.06	0.00
Total	**3.13**	**2.63**	**2.78**	**1.66**

Source: Abbadi et. al. 2019

The table shows that the Type I and Type II multipliers for social housing were found to be 2.63 and 3.13 respectively. And the difference between the two captures the induced effect which is 0.5. In comparison, the Type I and Type II multipliers for the construction sector as a whole were found to be 1.66 and 2.78 respectively. The multipliers are composed of contributions from the different sectors and the sectoral breakdown of the multipliers is also shown.

Step 5: Estimating the employment effects of social housing investment

To estimate the employment effects of the social housing project first, we need to calculate the **employment multipliers** of social housing. This step is again already captured in detail in Unit 3 of the ETE Toolkit it is thus just summarized here.

- The employment multiplier refers to the number of jobs created as a result of one million GHS investment made in social housing. They can be computed by multiplying the output multipliers already derived by the employment to outputs ratio (EO ratios):

$$\textit{Employment Multiplier} = \textit{Output Multiplier} * \textit{EO ratios} \quad (1)$$

- Employment-output ratio (EO ratios) measure the number of workers needed to produce one unit worth of sectoral output for a specified year – hence, how much labour is used per unit of output. Thus, the ratio is computed by dividing the total employment in a given sector by the total output of the same sector.

$$\textit{EO ratio} = \frac{\textit{(Total employment)}}{\textit{(Total output)}} \quad (2)$$

Employment-output ratios for Ghana

The sectoral employment data as presented in full-time equivalents (FTEs) used in this analysis are based on the Labour Force Survey 2015[22]. The sectoral output, was obtained from the Ghana 2015 SAM. Using equation (2), the employment-output ratio for Ghana were calculated and presented in **Table A4.10**.

22 As presented in the 2015 Labour Force Report (GSS 2016) data which is available from the *Ghana Statistical Services (GSS)*.

Table A3.9
Employment-output ratios for Ghana in each sector

Sectors	Sectoral employment in FTEs (LFS 2015)	Sectoral output in million GHS (2015)	Employment-Output ratios (FTEs per million GHS)
Agriculture, forestry and fishing	3 213 166	29 956	107
Mining and quarrying	56 727	30 803	2
Agro-processing	601 828	9 598	63
Other food processing	1 128	892	1
Textile and clothing	54 791	1 155	47
Wood and paper	76 352	3 516	22
Petroleum and Chemicals	15 996	10 351	2
Non-metal minerals	28 731	1 205	24
Metals and metal products	21 130	1 265	17
Other manufacturing	9 473	355	27
Electricity, gas and steam	11 998	8 526	1
Water supply and sewage	28 846	4 531	6
Construction	**281 497**	**28 370**	**10**
Social housing	1 197	40	30
Wholesale and retail trade	2 181 023	20 067	109
Transportation and storage	330 794	22 119	15
Accommodation and food services	460 557	11 215	41
Information and communication	49 491	8 179	6
Finance and insurance	87 071	7 890	11
Real estate activities	6 753	6 068	1
Business services	154 853	10 745	14
Public administration	240 864	14 831	16
Education	450 778	9 039	50
Health and social work	282 248	3 576	79
Other services	372 031	5 932	63

*Total FTEs and output data for social housing are computed from project data

Source: Labour Force Survey (2015) and Social Accounting Matrix (2015)

It is important to note the large differences in employment output ratios between sectors in Ghana, and in particular to note the low apparent productivity of the agriculture sector (107 FTEs per 1 million GH₵ output) and wholesale and retail (109 FTEs per 1 million GH₵ output) compared to other sectors. This low productivity in agriculture and wholesale and retail, is associated with the high levels of informality of these sectors and this will have important implications for estimating employment effects because any increase in the output of these sectors will result in a large increase in the estimated number of additional labour required.

Based on the findings form the project, the employment to output ratio for social housing differed from that of the construction sector as a whole. For the project, it was found that the total labour input was 1197 FTEs and the value of the total output was USD 10.67 million. This implies an employment output ratio of 112 FTEs/ USD million, which is equivalent to approximately **29 FTE / GHS million**. This is substantially higher than the **10 FTE/ GHS million** for the construction sector as a whole as obtained from the national LFS data.

Estimating employment multipliers and employment effects

Once the output multipliers and EO ratios are available the employment multipliers can be calculated using equation (1). These results are presented in **Table A3.10**. The Type II and Type I multipliers of social housing are presented in column (2) and column (3) respectively and the EO ratios are presented in column (4) of the table. The total employment multipliers are computed by multiplying each multiplier in column (2) by their respective EO ratios in column (4). The indirect effects are also computed by multiplying each element in column (4) of the table by the EO ratios. The total employment multipliers of social housing are presented in column (5) and estimated to be 106 FTEs and the indirect and induced components of these multipliers in columns (6) and (7). This implies that every 1 million investment made in social housing, 106 FTEs jobs would be created in the Ghanaian economy. Of which 36 FTEs would be indirect effects, 41 FTEs would be induced effects and the remaining 29 FTEs would be direct effects in social housing itself.

Table A3.10
Employment multipliers of social housing

	2	3	4	5	6	7
	Social Housing Multipliers			Employment multipliers		
Sectors	Type II Multipliers	Type I Multipliers	EO ratios	Total	Indirect	Induced
Agriculture, forestry and fishing	0.23	0.12	107	24.6	12.8	11.77
Mining and quarrying	0.05	0.09	2	0.1	0.2	0.00
Agro-processing	0.14	0.01	63	8.8	0.6	8.19
Textile and clothing	0.04	0.00	47	1.9	0.0	1.88
Wood and paper	0.15	0.17	22	3.3	3.7	0.00
Petroleum and Chemicals	0.16	0.18	2	0.3	0.4	0.00
Non-metal minerals	0.27	0.39	24	6.5	9.4	0.00
Metals and metal products	0.23	0.33	17	3.9	5.6	0.00
Machinery and equipment	0.10	0.10	-	-	-	-
Other manufacturing	0.01	0.01	27	0.3	0.3	0.00
Electricity, gas and steam	0.05	0.05	1	0.1	0.1	0.00
Water supply and sewage	0.03	0.00	6	0.2	0.0	0.18
Social housing	**1.00**	**1.00**	**29**	**29.0**	**0.0**	**0.00**
Construction	0.08	0.08	10	0.8	0.8	0.00
Wholesale and retail trade	0.13	0.01	109	14.2	1.1	13.08
Transportation and storage	0.15	0.02	15	2.3	0.3	1.95
Accommodation and food services	0.07	0.00	41	2.9	0.0	2.87
Information and communication	0.04	0.01	6	0.2	0.1	0.18
Finance and insurance	0.04	0.02	11	0.4	0.2	0.22
Real estate activities	0.03	0.01	1	0.0	0.0	0.02
Business services	0.03	0.03	14	0.4	0.4	0.00
Public administration	0.01	0.00	16	0.2	0.0	0.16
Education	0.03	0.00	50	1.5	0.0	1.50
Health and social work	0.01	0.00	79	0.8	0.0	0.79
Other services	0.05	0.00	63	3.2	0.0	3.15
Total	**3.13**	**2.63**	**-**	**106**	**36**	**46**

From employment multipliers to employment effects

- Using the employment multipliers and the spending on the project (x), the indirect and induced employment effects can be estimated using the equation:

  Employment effects= Employment Multipliers* x

- For the project which had a value of GHS 40 million, the total employment effect was thus 106 * 40 = 4,240 FTEs. Of this the indirect effect is 36 * 40 = 1,440 FTEs and the induced effect is 46 * 40= 1,840 FTEs.

It is assumed that the project reviewed was typical of the government's social housing portfolio, the same approach can be used to estimate the employment effect of the entire portfolio. According to the Ministry of Works and Housing, between 2018 and 2020 the government plans to invest an average of GHS 1,570 million in social housing construction per year. If we treat this as an exogenous shock(x) estimates of the employment effects then can be computed using the following equation:

Based on this the total employment effects of the social housing investment by the Ghanaian government is estimated at 174,000 FTEs. Of these, around 45,500 FTEs would be direct jobs created in social housing, around 56,500 FTEs would be indirect jobs created in the sectors which supply inputs to social housing, and 72,000 FTEs induced jobs. These results and the breakdown by sector are presented in **Table A3.11**.

It should be noted however that a large share (35%) of the total estimated FTEs are created in two sectors, namely agriculture and wholesale and retail trade. As was mentioned earlier the employment output ratio of these two sectors is very low. This is due to the low productivity and these two sectors. It is therefore also clear whether these two sectors would respond to increased demand by increasing employment, or by also increasing productivity. For these reasons, the employment estimates from these two sectors were not included in the overall estimates in the final report as there was a high risk these were inflating the estimate and creating an impression that the employment effects would be much greater than are probable.

Table A3.11
Estimated employment effects of social housing by sector and effect

	Employment Multipliers			Employment effects				
Sectors	Direct	Indirect	Induced	Exogenous Shock	Direct	Indirect	Induced	Total
Agriculture, forestry and fishing	0	12.8	11.77	1570	0	20096	18479	38575
Mining and quarrying	0	0.2	0	0	0	314	0	314
Agro-processing	0	0.6	8.19	0	0	942	12858	13800
Textile and clothing	0	0	1.88	0	0	0	2952	2952
Wood and paper	0	3.7	0	0	0	5809	0	5809
Petroleum and Chemicals	0	0.4	0	0	0	628	0	628
Non-metal minerals	0	9.4	0	0	0	14758	0	14758
Metals and metal products	0	5.6	0	0	0	8792	0	8792
Machinery and equipment	0	0.3	0	0	0	471	0	471
Other manufacturing	0	0.1	0	0	0	157	0	157
Electricity, gas and steam	0	0	0.18	0	0	0	283	283
Water supply and sewage	0	0.8	0	0	0	1256	0	1256
Social housing	**29**	**0**	**0**	**0**	**45530**	**0**	**0**	**45530**
Construction	0	1.1	13.08	0	0	1727	20536	22263
Wholesale and retail trade	0	0.3	1.95	0	0	471	3062	3533
Transportation and storage	0	0	2.78	0	0	0	4506	4506
Accommodation and food services	0	0.1	0.18	0	0	157	283	440
Information and communication	0	0.2	0.22	0	0	314	345	659
Finance and insurance	0	0	0.02	0	0	0	31	31
Real estate activities	0	0.4	0	0	0	628	0	628
Business services	0	0	0.16	0	0	0	251	251
Public administration	0	0	1.5	0	0	0	2355	2355
Education	0	0	0.79	0	0	0	1240	1240
Health and social work	0	0	3.15	0	0	0	4946	4946
Other services	29	36	45.85	1570	45530	56520	72127	174177
Total	**3.13**	**2.63**	**-**	**106**	**36**	**46**	**46**	**46**

Source: Abbadi et. al. 2019

Annex 4. Values of key indicators from different regions and for different investments

Annex 4a: Micro (Project) level indicators of selected projects*

Global region	Country	Project/Programme	Infrastructure Type: Main Category	Sub category	Project Details	Technology	Year of study	Cost (original currency (millions)	Currency	Labour cost (original currency)	Currency	Cost (USD millions)	Labour cost (USD millions)
MENA	Morocco	PNRR2	Transportation		National Programme of Rural Roads, large scale project with many sub-projects (information for 71.13 km of roads included in the study)	Equipment based	2015	88	MAD	10.4	MAD	9.0	1.1
MENA	Morocco	Solar Project (Ouarzazate)	Energy		Solar Energy plant in Ouarzazate, 500MW Plant	Equipment based	2015	1000	USD	106	MAD	102.0	10.8
MENA	Morocco	Sanitation Oujda	Sanitation		Sanitation in Oujda, Sewage network, treatment plant and storm water drainage	Equipment based	2015	437	MAD	49	MAD	44.6	5.0
MENA	Morocco	Sanitation Sebou	Sanitation		Sanitation in Sebou Basin, Infrastructure for collection and treatment in 17 urban centers	Equipment based	2015	237	MAD	13	MAD	24.2	1.3
MENA	Tunisia	Priority Roads	Transportation		Urban Priority Roads, 12 sub-projects to reduce traffic congestion	Equipment based	2015	41.9	Euro	5.96	Euro	45.7	6.5
MENA	Tunisia	Sousse Power Station	Energy		Power station in Sousse, Construction and operation of dual-fuel power plant (This O&M figure is based on 150 full time staff for 25 years, plus 1.4 maintence staff per year for 25 years and the 63 staff on maintence contracts for 25 years).	Equipment based	2015	300	Euro	28.2	Euro	327.0	30.7
MENA	Jordan	Amman Ring Road	Transportation		Ring road in Amman, 41m four-lane highway	Equipment based	2015	160	JOD	41	JOD	223.6	57.3
MENA	Jordan	Tafila Wind Farm	Energy		Windfarm in Tafilah, 117MW wind farm with 38 turbines	Equipment based	2015	230	Euro	N/A		250.7	N/A
MENA	Egypt	Giza Power Station	Energy		Power plant in Giza, 2,250MW power plant	Equipment based	2015	651	USD	65	USD	651.0	65.0
MENA	Egypt	Power Transmission	Energy		Egypt Power Transmission, 10 transmission lines, 1 underground cable, 10 substations and 22 transformers	Equipment based	2015	49	USD	5.5	USD	49.0	5.5
MENA	Egypt	EPAP II	Environment		EPAPII, Pollution abatement in various industries in Alexandria and Greater Cairo governorates	Equipment based	2015	86.5	USD	3.2	USD	86.5	3.2
Sub-Saharan Africa	South Africa	EPWP 1	Buildings		Expanded Public Works Program (EPWP) (1) - Programme intended to generate employment through labour-intensive methods but potential not fully exploited as indicated by labour intensity.	Equipment based	2011	13815	ZAR	359	ZAR	1945.8	50.6
Sub-Saharan Africa	South Africa	EPWP 1	Energy - Electricity		Expanded Public Works Program (EPWP) (1)		2011	223	ZAR	51	ZAR	31.4	7.2
Sub-Saharan Africa	South Africa	EPWP 1	Transportation - Roads (construction and maintenance)		Expanded Public Works Program (EPWP) (1)		2011	6 430	ZAR	714	ZAR	905.6	100.6
Sub-Saharan Africa	South Africa	EPWP 1	Sanitation		Expanded Public Works Program (EPWP) (1)		2011	816	ZAR	65	ZAR	114.9	9.2
Sub-Saharan Africa	South Africa	EPWP 1	Stormwater		Expanded Public Works Program (EPWP) (1)		2011	344	ZAR	13	ZAR	48.5	1.8
Sub-Saharan Africa	South Africa	EPWP 1	Waste management		Expanded Public Works Program (EPWP) (1)		2011	51	ZAR	20	ZAR	7.2	2.8
Sub-Saharan Africa	South Africa	EPWP 1	Water supply		Expanded Public Works Program (EPWP) (1)		2011	1 175	ZAR	136	ZAR	165.5	19.2
Sub-Saharan Africa	South Africa	EPWP 1	Total		Expanded Public Works Program (EPWP) (1)		2011	22 854	ZAR	1 358	ZAR	3218.9	191.3
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance		Four road maintenance projects including rehabilitation and periodic maintenance in different terrains of about 25km of road	Labour-intensive approach	2007	0.18	USD	0.05	USD	0.2	0.05
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance		Four road maintenance projects including rehabilitation, periodic maintenance and treatment of critical areas in different terrains of about 129km of road	Semi-mechanized	2007	1.9	USD	0.47	USD	1.9	0.47
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance		Three road maintenance projects including rehabilitation and periodic maintenance in different terrains of about 180km of road	Equipment based	2007	9.9	USD	0.79	USD	9.9	0.79
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools		Three schools including a total of 8 classrooms, 18 latrines, 2 tanks and one water point	Local resource-based approach	2007	0.05	USD	0.006	USD	0.05	0.006
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools		Three schools including a total of 14 classrooms, 3 latrines and 1 tank using mixed approach (Concrete roof frames and metal work for windows and doors)	Mixed approach	2007	0.12	USD	0.017	USD	0.120	0.017
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools		Two schools including rehabilitation and building of classrooms, offices and facilities using mixed approach (Metal roof frames and metal work for windows and doors)	Mixed approach	2007	0.10	USD	0.012	USD	0.1	0.012
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools		Three schools including 78 classrooms using prefabricated components	Pre-fabricated	2007	0.80	USD	0.060	USD	0.8	0.060
Sub-Saharan Africa	Madagascar	Multiple projects	Irrigation		Rehabilitation of irrigation network serving a total area of 610 hectares of land	Labour-intensive approach	2007	0.22	USD	0.040	USD	0.22	0.040
Sub-Saharan Africa	Madagascar	Multiple projects	Irrigation		Rehabilitation of irrigation network serving a total area of 760 hectares of land	Equipment-based	2007	0.35	USD	0.030	USD	0.35	0.030
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation-roads		Pavement of two roads using cobalt stone (total surface of 2,386 square meters)	Local resource-based approach	2007	5.810	USD	1.930	USD	5.81	1.930
Sub-Saharan Africa	Ghana	One project	Social Housing		Construction of 280 Housing Units (Apartments) in 18 buildings, suburban Accra	Mixed approach as per local concventions	2018	10.668	USD	4.694	USD	10.67	4.694
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)		Employment through labor Intensive Infrastructure Program in Jordan (Phase I - Work under agriculture sector-Farm improvement, Forestry and Irrigation) ILO project	Labour-intensive approach	2018	0.581	USD	0.331	USD	0.58	0.331
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)		Water Cisterns, ILO project, Job Creation for Syrian Refugees and Jordanian host communities through Green Works in Agriculture and Forestry	Labour-intensive approach	2018	0.254	USD	0.079	USD	0.25	0.079
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)		Reforestation activities, ILO project, Job Creation for Syrian Refugees and Jordanian host communities through Green Works in Agriculture and Forestry	Labour-intensive approach	2018	0.657	USD	0.510	USD	0.66	0.510
MENA	Jordan	Project	Rural Roads		Routine road maintenance, Balama, Mafraq, EIIP, ILO project	Labour-intensive approach	2018	0.345	USD	0.173	USD	0.35	0.173
MENA	Jordan	Project	Rural Roads		Routine road maintenance, Manshyeh, Mafraq, EIIP, ILO project	Labour-intensive approach	2018	0.272	USD	0.139	USD	0.27	0.139
MENA	Jordan	Project	Highway		22 km of ring road for Al Salt, Jordan	Equipment based	2018	50.783	USD	10.055	USD	50.78	10.055
MENA	Jordan	Project	Highway		Upgrading of 110 km of major highway, Azraq (Highway 30)	Equipment based	2018	148.785	USD	32.584	USD	148.79	32.584
MENA	Lebanon	Project	Rural Roads		Rehabilitation of 4.3 km of rural road, Ba'albak, direct implementation	Labour-intensive approach		0.370	USD	0.272	USD	0.37	0.272
MENA	Lebanon	Project	Rural Roads		Rehabilitation of 7.28km, Jbeil District, Mt Lebanon		2018	7.300		2.400	USD	7.30	2.400
MENA	Lebanon	Project	Highway		Rehabilitation of 12 km of road, Nabatieh	Equipment based	2018	7.540	USD	1.600	USD	7.54	1.600
MENA	Lebanon	Project	Highway		Rehabilitation and widening of 14.7 km of road, Chouf District	Equipment based	2018	14.826	USD	2.520	USD	14.83	2.520
MENA	Lebanon	Project	Urban Road Construction		Rehabilitation of 1.7 km of road, Hazmieh Region	Equipment based	2018	3.079	USD	0.579	USD	3.08	0.579
										Minimum		7.2	1.1
										Maximum		1945.8	100.6

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Annex 4a: Micro (Project) level indicators of selected projects*

Country and project information				Recommended key indicators															
						Short term employment (during construction phase)													
Global region	Country	Project/Programme	Infrastructure Type: Main Category	Labour Intensity (total wage bill)	Total Number of employees	Employment Total	units	Non-Youth Male	Non-Youth Female	Youth-Male	Youth-Female	Female % of construction stage employees	Youth (16 - 29 years) as % of construction stage employees	Total wages paid	Currency	Non-Youth Male	Non-Youth Female	Youth-Male	Youth-Female
MENA	Morocco	PNRR2	Transportation	12%		218	FTE					0.0%		10 400 000	MAD				
MENA	Morocco	Solar Project (Ouarzazate)	Energy	11%		950	FTE					0.0%		106 000 000	MAD				
MENA	Morocco	Sanitation Oujda	Sanitation	11.2%		850	FTE							49 000 000	MAD				
MENA	Morocco	Sanitation Sebou	Sanitation	5.5%		496	FTE							13 000 000	MAD				
MENA	Tunisia	Priority Roads	Transportation	14.2%		1096	FTE							5 960 000	Euro				
MENA	Tunisia	Sousse Power Station	Energy	9.4%		6265	FTE					0.0%		28 200 000	Euro				
MENA	Jordan	Amman Ring Road	Transportation	25.6%		4727	FTE					0.0%		41 000 000	JOD				
MENA	Jordan	Tafila Wind Farm	Energy	N/A		230	FTE							NA	-				
MENA	Egypt	Giza Power Station	Energy	10.0%		4879	FTE					0.0%		65 000 000	USD				
MENA	Egypt	Power Transmission	Energy	11.2%		1439	FTE					0.0%		5 500 000	USD				
MENA	Egypt	EPAP II	Environment	3.7%		178	FTE					0.0%		3 200 000	USD				
Sub-Saharan Africa	South Africa	EPWP 1	Buildings	2.6%		21523	FTE							359 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Energy - Electricity	22.9%		2011	FTE							51 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Transportation - Roads (construction and maintenance)	11.1%		46089	FTE							714 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Sanitation	8.0%		3586	FTE							65 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Stormwater	3.8%		573	FTE							13 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Waste management	39.2%		1188	FTE							20 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Water supply	11.6%		6474	FTE							136 000 000	ZAR				
Sub-Saharan Africa	South Africa	EPWP 1	Total	5.9%		81444	FTE							1 358 000 000	ZAR				
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance	26.5%		20	FTE							48 335	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance	24.7%		122	FTE							470 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance	7.98%		41	FTE							790 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	11.34%										6 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	13.48%										17 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	12.1%										12 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	7.4%										60 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Irrigation	18.0%										40 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Irrigation	11.0%										30 000	USD				
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation-roads	33.0%										1 930 000	USD				
Sub-Saharan Africa	Ghana	One project	Social Housing	44.0%		1197	FTE					0.4%	NA	4 693 920	USD				
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)	57.0%		21946	days					NA	100%	331 170	USD				
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)	31.1%		3525	days					0.0%	100%	79 000	USD				
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)	77.6%		26211	days					11.1%	100%	510 000	USD				
MENA	Jordan	Project	Rural Roads	50.0%		8122	days					23.7%	NA	172 500	USD				
MENA	Jordan	Project	Rural Roads	51.0%		6551	days					17.3%	NA	138 720	USD				
MENA	Jordan	Project	Highway	19.8%		268 015	days					2.2%	NA	10 055 034	USD				
MENA	Jordan	Project	Highway	21.9%		601 787	days					0.0%	NA	32 583 915	USD				
MENA	Lebanon	Project	Rural Roads	73.5%	26	7 950	days					NA	NA	272 000	USD				
MENA	Lebanon	Project	Rural Roads	32.9%	300	59 625	days					NA	NA	2 400 000	USD				
MENA	Lebanon	Project	Highway	21.2%	54	48 600	days					NA	NA	1 600 000	USD				
MENA	Lebanon	Project	Highway	17.0%		62 016	days					NA	NA	2 520 420	USD				
MENA	Lebanon	Project	Urban Road Construction			13 486	Days					4.0%	NA	579 000	USD				
				2.6%		178													
				39.2%		46 089													

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Annex 4a: Micro (Project) level indicators of selected projects*

Country and project information				Derived Indicators						
Global region	Country	Project/Programme	Infrastructure Type: Main Category	Labour intensity	Average wage	Unit	Average duration of employment (days)	Average income per workers	Cost per FTE (or per day) (local currency)	FTE/million USD
MENA	Morocco	PNRR2	Transportation	11.8%	3 976	Local/month			403 670	205
MENA	Morocco	Solar Project (Ouarzazate)	Energy	10.6%	9 298	Local/month			1 052 632	88
MENA	Morocco	Sanitation Oujda	Sanitation	11.2%	4 804	Local/month			514 118	170
MENA	Morocco	Sanitation Sebou	Sanitation	5.5%	2 184	Local/month			477 823	374
MENA	Tunisia	Priority Roads	Transportation	14.2%	453	Local/month			38 230	169
MENA	Tunisia	Sousse Power Station	Energy	9.4%	375	Local/month			47 885	204
MENA	Jordan	Amman Ring Road	Transportation	25.6%	723	Local/month			33 848	83
MENA	Jordan	Tafila Wind Farm	Energy	NA	NA	Local/month			1 000 000	NA
MENA	Egypt	Giza Power Station	Energy	10.0%	1 110	Local/month			133 429	75
MENA	Egypt	Power Transmission	Energy	11.2%	319	Local/month			34 051	262
MENA	Egypt	EPAP II	Environment	3.7%	1 498	Local/month			485 955	56
Sub-Saharan Africa	South Africa	EPWP 1	Buildings	2.6%	1 390	Local/month			641 871	426
Sub-Saharan Africa	South Africa	EPWP 1	Energy - Electricity	22.9%	2 113	Local/month			110 890	280
Sub-Saharan Africa	South Africa	EPWP 1	Transportation - Roads (construction and maintenance)	11.1%	1 291	Local/month			139 513	458
Sub-Saharan Africa	South Africa	EPWP 1	Sanitation	8.0%	1 511	Local/month			227 552	392
Sub-Saharan Africa	South Africa	EPWP 1	Stormwater	3.8%	1 891	Local/month			600 349	313
Sub-Saharan Africa	South Africa	EPWP 1	Waste management	39.2%	1 403	Local/month			42 929	422
Sub-Saharan Africa	South Africa	EPWP 1	Water supply	11.6%	1 751	Local/month			181 495	338
Sub-Saharan Africa	South Africa	EPWP 1	Total	5.9%	1 390	Local/month			280 610	426
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance	26.5%	199	Local/month			9 043	418
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance	24.7%	321	Local/month			15 574	260
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation - Roads maintenance	8.0%	1 598	Local/month			240 291	52
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	12.0%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	14.2%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	12.0%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Madagascar	Multiple projects	Buildings - Schools	7.5%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Madagascar	Multiple projects	Irrigation	18.2%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Madagascar	Multiple projects	Irrigation	8.6%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Madagascar	Multiple projects	Transportation-roads	33.2%	#DIV/0!	Local/month			#DIV/0!	0
Sub-Saharan Africa	Ghana	One project	Social Housing	44.0%	326.78	USD/Month			8 912	112
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)	57.0%	15.09	USD/day			26	164
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)	31.1%	22.41	USD/day			72	60
MENA	Jordan	Programme	Irrigation and watershed management (Green Works)	77.6%	19.46	USD/day			25	173
MENA	Jordan	Project	Rural Roads	50.0%	21.24	USD/day			42	78
MENA	Jordan	Project	Rural Roads	51.0%	21.18	USD/day			42	80
MENA	Jordan	Project	Highway	19.8%	37.52	USD/day			189	18
MENA	Jordan	Project	Highway	21.9%	54.15	USD/day			247	13
MENA	Lebanon	Project	Rural Roads	73.5%	34.21	USD/day	306	10 462	47	72
MENA	Lebanon	Project	Rural Roads	32.9%	40.25	USD/day	199	8 000	122	27
MENA	Lebanon	Project	Highway	21.2%	32.92	USD/day	900	29 630	155	21
MENA	Lebanon	Project	Highway	17.0%	40.64	USD/day			239	14
MENA	Lebanon	Project	Urban Road Construction	18.8%	42.93	USD/day			228	15
				#VALEUR!	#VALEUR!				-	168
				#VALEUR!	#VALEUR!				-	458

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Annex 4b: Macro (Country) level indicators from selected assessments*

Country and programme or project information									
Region number	Global region	Country	Project / Programme	Sector /Infrastructure type	Technology	Year of Study (Year of data inputs)	Cost / Investment (original currency, millions)	Original Currency	Cost / Investment (USD, millions)
1	MENA (LMIC)	Egypt	Giza Power Station	Energy	High Technology	2015 (2011)	2200.0	USD	2200.0
1	MENA (LMIC)	Egypt	Power Transmission Project	Energy	High Technology	2015 (2011)	700.0	USD	700.0
1	MENA (LMIC)	Egypt	EPAP 2	Environment	High Technology	2015 (2011)	150.0	USD	150.0
1	MENA (HMIC)	Jordan	Amman Ring Road	Transportation	High Technology	2014 (2010)	160.0	JOD	223.6
1	MENA (HMIC)	Jordan	Tafila Wind Park	Energy	High Technology	2014 (2010)	230.0	Euro	250.7
1	MENA (LMIC)	Morocco	PNRR 2	Transportation	Lower Technology	2014 (2003-2012)	650.0	USD	650.0
1	MENA (LMIC)	Morocco	Solar Project	Energy	High Technology	2014 (2003-2012)	1000.0	USD	1000.0
1	MENA (LMIC)	Morocco	Sanitation Oujda	Sanitation	High Technology	2014 (2003-2012)	65.0	Euro	70.9
1	MENA (LMIC)	Morocco	Sanitation Sebou	Sanitation	High Technology	2014 (2003-2012)	87.0	Euro	94.8
1	MENA (HMIC)	Tunisia	Priority Roads	Transportation	Lower Technology	2014 (2011)	143.7	Euro	156.6
1	MENA (HMIC)	Tunisia	Sousee Power station	Energy	High Technology	2014 (2011)	388.0	Euro	422.9
2	South Asia (LMIC)	India (Gujarat)	Simulation - Irrigation Canal	Irrigation	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (Gujarat)	Simulation - Highways/ Urban Roads	Transportation	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (Gujarat)	Simulation - Rural Roads	Transportation	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (Gujarat)	Simulation - Other	Average	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (West Bengal)	Simulation - Irrigation Canal	Irrigation	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (West Bengal)	Simulation - Highways/ Urban Roads	Transportation	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (West Bengal)	Simulation - Rural Roads	Transportation	No information	2015 (2009-2010)	0.1	RP	0.0015
2	South Asia (LMIC)	India (West Bengal)	Simulation - Other	Average	No information	2015 (2009-2010)	0.1	RP	0.0015
3	South East Asia (LMIC)	Indonesia	Fiscal Stimulus Package (Varied Projects)	Infrastructure	No information	2011 (2000-2008)	10800000.0	RP	14644.8
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Roads	Transportation	Labour Intensive	2011 (2000-2008)	1000.0	RP	1.4
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Roads	Transportation	Capital Intensive	2011 (2000-2008)	1000.0	RP	1.4
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Irrigation	Sanitation	No information	2011 (2000-2008)	1000.0	RP	1.4
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Other	Infrastructure	No information	2011 (2000-2008)	1000.0	RP	1.4
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Employment Intensive Approach to Infrastructure	Transportation	Employemnt Intensive	2011 (2008)	48.0	USD	48.0
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Conventional Approach to Infrastructure	Transportation	Conventional Approach	2011 (2008)	48.0	USD	48.0
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Employment Intensive Approach to Infrastructure	Other	Employemnt Intensive	2011 (2008)	45.3	USD	45.3
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Conventional Approach to Infrastructure	Other	Conventional Approach	2011 (2008)	45.3	USD	45.3
4	Sub Saharan Africa (LIC)	Ghana	Social Housing Assessment	Housing	Concentional	2017 (2019)	47.4	GHC	10.6
4	Sub Saharan Africa (LIC)	Rwanda	Simulation	Feeder Roads	Labour Intensive	2015 (2019)	41.0	USD	
4	Sub Saharan Africa (LIC)	Rwanda	Simulation	Feeder Roads	Capital Intensive	2015 (2019)	41.0	USD	

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Country and programme or project information									
Region number	Global region	Country	Project / Programme	Sector /Infrastructure type	Technology	Year of Study (Year of data inputs)	Cost / Investment (original currency, millions)	Original Currency	Cost / Investment (USD, millions)
5	UMIC	Turkey	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
5	UMIC	Turkey	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
6	HIC:Non-OECD	Latvia	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
6	HIC:Non-OECD	Latvia	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
6	HIC:Non-OECD	Lithuania	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
6	HIC:Non-OECD	Lithuania	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
6	South East Asia (HIC:Non-OECD)	Taiwan	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
6	South East Asia (HIC:Non-OECD)	Taiwan	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Greece	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Greece	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Hungary	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Hungary	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Ireland	Simulation - Roads (Construction)	Transportation	Lower Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - Roads (Improvements)	Transportation	Lower Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - Rail	Transportation	High Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - School	Buildings	Lower Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - Hospital	Buildings	Lower Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - Social Housing	Buildings	Lower Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - Drinking/ Wastewater Treatment	Sanitation	High Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - High Volatage Power Line	Energy	Lower Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Ireland	Simulation - Gas Power Station	Energy	High Technology	2013 (2009)	1000.0	Euro	1090.0
7	HIC:OECD	Japan	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Japan	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Poland	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	Poland	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	USA	Energy	Infrastructure	No information	2009 (Unclear)	Simulation		100.0
7	HIC:OECD	USA	Transportation	Infrastructure	No information	2009 (Unclear)	Simulation		100.0
7	HIC:OECD	USA	School buildings	Infrastructure	No information	2009 (Unclear)	Simulation		100.0
7	HIC:OECD	USA	Water	Infrastructure	No information	2009 (Unclear)	Simulation		100.0
7	HIC:OECD	USA	Simulation	Construction	No information	2014 (1999-2005)	Simulation		100.0
7	HIC:OECD	USA	Simulation	Average	No information	2014 (1999-2005)	Simulation		100.0

Annex 4b: Macro (Country) level indicators from selected assessments*

Country and programme or project information				Recommended key indicators							
Region number	Global region	Country	Project / Programme	Total FTE per million USD of investment (Total Jobs/Cost of investment (m USD)	Direct FTE per million USD of investment (Direct Jobs/ Cost of investment (m USD)	Indirect FTE per million USD of investment (Indirect Jobs/ Cost of investment (m USD)	Induced FTE per million USD of investment (Induced Jobs/ Cost of investment (m USD)	T1 Multiplier (Direct Jobs + Indirect Jobs]/ Direct Jobs)	T2 Multiplier (Direct Jobs + Indirect Jobs + Induced Jobs]/ Direct Jobs)	Investment cost per FTE year of employment created (USD) - Direct, indirect and induced	Investment cost per FTE year of employment created (USD) - Direct only
1	MENA (LMIC)	Egypt	Giza Power Station	30.5	5.1	20.3	5	4.97	5.97	32 783	195 782
1	MENA (LMIC)	Egypt	Power Transmission Project	5.0	0.9	3.0	1	4.19	5.32	201 555	1 073 620
1	MENA (LMIC)	Egypt	EPAP 2	40.9	7.7	24.5	9	4.18	5.32	24 462	130 208
1	MENA (HMIC)	Jordan	Amman Ring Road	46.2	17.1	15.2	14	1.87	2.67	21 651	58 516
1	MENA (HMIC)	Jordan	Tafila Wind Park	52.4	21.5	18.9	12	1.87	2.42	19 092	46 566
1	MENA (LMIC)	Morocco	PNRR 2	76.2	19.9	31.3	25	2.58	3.83	13 124	50 282
1	MENA (LMIC)	Morocco	Solar Project	39.9	8.2	28.0	4	4.41	4.86	25 092	121 804
1	MENA (LMIC)	Morocco	Sanitation Oujda	82.6	28.7	42.6	11	2.48	2.88	12 103	34 878
1	MENA (LMIC)	Morocco	Sanitation Sebou	79.3	29.6	38.2	12	2.29	2.68	12 605	33 794
1	MENA (HMIC)	Tunisia	Priority Roads	54.0	34.3	11.6	8	1.34	1.57	18 506	29 136
1	MENA (HMIC)	Tunisia	Sousee Power station	10.9	6.8	2.4	2	1.35	1.61	91 502	146 949
2	South Asia (LMIC)	India (Gujarat)	Simulation - Irrigation Canal	2147.5	375.1	222.7	1550	1.59	5.72	466	2 666
2	South Asia (LMIC)	India (Gujarat)	Simulation - Highways/ Urban Roads	2035.5	269.1	215.4	1551	1.80	7.56	491	3 716
2	South Asia (LMIC)	India (Gujarat)	Simulation - Rural Roads	3335.2	1507.9	266.4	1561	1.18	2.21	300	663
2	South Asia (LMIC)	India (Gujarat)	Simulation - Other	2151.4	222.7	351.3	1577	2.58	9.66	465	4 490
2	South Asia (LMIC)	India (West Bengal)	Simulation - Irrigation Canal	5676.2	2073.2	393.0	3210	1.19	2.74	176	482
2	South Asia (LMIC)	India (West Bengal)	Simulation - Highways/ Urban Roads	4181.6	464.0	456.7	3261	1.98	9.01	239	2 155
2	South Asia (LMIC)	India (West Bengal)	Simulation - Rural Roads	5089.0	1450.2	454.7	3184	1.31	3.51	197	690
2	South Asia (LMIC)	India (West Bengal)	Simulation - Other	4369.2	575.3	497.1	3297	1.86	7.59	229	1 738
3	South East Asia (LMIC)	Indonesia	Fiscal Stimulus Package (Varied Projects)	20.0						49 982	
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Roads	36.4						27 505	
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Roads	17.3						57 702	
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Irrigation	17.6						56 736	
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Other	22.4						44 605	
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Employment Intensive Approach to Infrastructure	1408.4	1061.4	1061.4				710	942
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Conventional Approach to Infrastructure	893.3	814.1	814.1				1 119	1 228
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Employment Intensive Approach to Infrastructure	924.3	240.2	684.1				1 082	4 163
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Conventional Approach to Infrastructure	299.8	55.4	244.4				3 336	18 049
4	Sub Saharan Africa (LIC)	Ghana	Social Housing Assessment	272.0	112.0	81.0	79	2.60	3.10	3 676	8 929
4	Sub Saharan Africa (LIC)	Rwanda	Simulation	600.0	413.0			1.80	2.80	1 667	2 418
4	Sub Saharan Africa (LIC)	Rwanda	Simulation	250.0	74.0			1.90	2.90	4 000	13 513

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Country and programme or project information				Recommended key indicators							
Region number	Global region	Country	Project / Programme	Total FTE per million USD of investment (Total Jobs/Cost of investment (m USD)	Direct FTE per million USD of investment (Direct Jobs/ Cost of investment (m USD)	Indirect FTE per million USD of investment (Indirect Jobs/ Cost of investment (m USD)	Induced FTE per million USD of investment (Induced Jobs/ Cost of investment (m USD)	T1 Multiplier (Direct Jobs + Indirect Jobs]/ Direct Jobs)	T2 Multiplier (Direct Jobs + Indirect Jobs + Induced Jobs]/ Direct Jobs)	Investment cost per FTE year of employment created (USD) - Direct, indirect and induced	Investment cost per FTE year of employment created (USD) - Direct only
5	UMIC	Turkey	Simulation	39.8	6.1	22.5	11.2	4.69	6.52	25 126	163 934
5	UMIC	Turkey	Simulation	41.8	6.4	27.0	8.4	5.22	6.53	23 923	156 250
6	HIC:Non-OECD	Latvia	Simulation	37.5	5.2	19.7	12.6	4.79	7.21	26 667	192 308
6	HIC:Non-OECD	Latvia	Simulation	30.9	6.1	13.3	12	3.18	5.07	32 362	163 934
6	HIC:Non-OECD	Lithuania	Simulation	43.3	5.5	25.3	12.5	5.60	7.87	23 095	181 818
6	HIC:Non-OECD	Lithuania	Simulation	53.6	8.3	31.8	13.5	4.83	6.46	18 657	120 482
6	South East Asia (HIC:Non-OECD)	Taiwan	Simulation	42.4	4.9	21.5	16.0	5.39	8.65	23 585	204 082
6	South East Asia (HIC:Non-OECD)	Taiwan	Simulation	51.3	7.3	28.4	15.6	4.89	7.03	19 493	136 986
7	HIC:OECD	Greece	Simulation	26.5	2.9	12.2	11.4	5.21	9.14	37 736	344 828
7	HIC:OECD	Greece	Simulation	28.5	4.5	13.8	10.2	4.07	6.33	35 088	222 222
7	HIC:OECD	Hungary	Simulation	36.5	5.3	20.9	10.3	4.94	6.89	27 397	188 679
7	HIC:OECD	Hungary	Simulation	42.9	5.8	27.1	10.0	5.67	7.40	23 310	172 414
7	HIC:OECD	Ireland	Simulation - Roads (Construction)	12.8	8.0	3.1	1.7	1.38	1.59	77 952	124 245
7	HIC:OECD	Ireland	Simulation - Roads (Improvements)	13.9	9.4	2.6	1.8	1.28	1.48	71 971	106 165
7	HIC:OECD	Ireland	Simulation - Rail	11.8	7.5	2.8	1.6	1.37	1.58	84 772	133 808
7	HIC:OECD	Ireland	Simulation - School	13.7	7.2	4.7	1.8	1.66	1.92	72 978	139 779
7	HIC:OECD	Ireland	Simulation - Hospital	13.3	6.7	4.9	1.8	1.73	1.99	75 059	149 602
7	HIC:OECD	Ireland	Simulation - Social Housing	14.5	8.2	4.4	1.9	1.54	1.78	68 831	122 307
7	HIC:OECD	Ireland	Simulation - Drinking/ Wastewater Treatment	11.8	5.7	4.4	1.6	1.77	2.05	85 004	173 955
7	HIC:OECD	Ireland	Simulation - High Volatage Power Line	16.0	8.7	5.1	2.1	1.58	1.83	62 604	114 436
7	HIC:OECD	Ireland	Simulation - Gas Power Station	9.3	2.5	5.6	1.2	3.20	3.69	107 146	395 357
7	HIC:OECD	Japan	Simulation	19.2	2.5	8.2	8.5	4.28	7.68	52 083	400 000
7	HIC:OECD	Japan	Simulation	23.3	2.5	10.5	10.3	5.20	9.32	42 918	400 000
7	HIC:OECD	Poland	Simulation	43.7	6.0	21.0	16.7	4.50	7.28	22 883	166 667
7	HIC:OECD	Poland	Simulation	40.2	6.9	19.7	13.6	3.86	5.83	24 876	144 928
7	HIC:OECD	USA	Energy	17.0						58 824	
7	HIC:OECD	USA	Transportation	19.0						52 632	
7	HIC:OECD	USA	School buildings	19.0						52 632	
7	HIC:OECD	USA	Water	20.0						50 000	
7	HIC:OECD	USA	Simulation	21.0	2.3	8.2	10.5	4.57	9.13	47 619	434 783
7	HIC:OECD	USA	Simulation	17.7	1.9	7.4	8.4	4.89	9.32	56 497	526 316
			Max	5 676.2	2 073.2	1 061.4	3 296.8	5.7	9.7	201 555	1 073 620
			Min	5.0	0.9	2.4	1.1	1.2	1.5	176	482
			Average	566.1	189.5	124.6	417.0	3.1	5.1	35 659	146 560

Annex 4b: Macro (Country) level indicators from selected assessments*

Country and programme or project information				Programme or project level employment information							
Region number	Global region	Country	Project / Programme	Total FTE year jobs - (Direct Jobs + Indirect Jobs + Induced Jobs)	Total Number of Direct Jobs	Direct % - (Direct Jobs/ Total JobsJ)	Total Number of Indirect Jobs	Indirect % - (Indirect Jobs/ Total Jobs}	Total Number of Induced Jobs	Induced % - (Induced Jobs/ Total Jobs}	Type
1	MENA (LMIC)	Egypt	Giza Power Station	67107	11237	17.0	44601	66.0	11269	17.0	I-O
1	MENA (LMIC)	Egypt	Power Transmission Project	3473	652	19.0	2080	60.0	741	21.0	I-O
1	MENA (LMIC)	Egypt	EPAP 2	6132	1152	19.0	3672	60.0	1308	21.0	I-O
1	MENA (HMIC)	Jordan	Amman Ring Road	10327	3821	37.0	3408	33.0	3098	30.0	I-O
1	MENA (HMIC)	Jordan	Tafila Wind Park	13131	5384	41.0	4727	36.0	3020	23.0	I-O
1	MENA (LMIC)	Morocco	PNRR 2	49529	12927	26.1	20356	41.1	16246	32.8	I-O
1	MENA (LMIC)	Morocco	Solar Project	39854	8210	20.6	27978	70.2	3667	9.2	I-O
1	MENA (LMIC)	Morocco	Sanitation Oujda	5854	2031	34.7	3015	51.5	808	13.8	I-O
1	MENA (LMIC)	Morocco	Sanitation Sebou	7523	2806	37.3	3619	48.1	1098	14.6	I-O
1	MENA (HMIC)	Tunisia	Priority Roads	8464	5376	63.0	1821	21.0	1267	15.0	I-O
1	MENA (HMIC)	Tunisia	Sousee Power station	4622	2878	62.0	1009	22.0	735	16.0	I-O
2	South Asia (LMIC)	India (Gujarat)	Simulation - Irrigation Canal		0.566	17.5	0.336	10.4	2.338	72.2	I-O
2	South Asia (LMIC)	India (Gujarat)	Simulation - Highways/ Urban Roads		0.406	13.2	0.325	10.6	2.340	76.2	I-O
2	South Asia (LMIC)	India (Gujarat)	Simulation - Rural Roads		2.275	45.2	0.402	8.0	2.355	46.8	I-O
2	South Asia (LMIC)	India (Gujarat)	Simulation - Other		0.336	10.4	0.530	16.3	2.380	73.3	I-O
2	South Asia (LMIC)	India (West Bengal)	Simulation - Irrigation Canal		3.128	36.5	0.593	6.9	4.843	56.6	I-O
2	South Asia (LMIC)	India (West Bengal)	Simulation - Highways/ Urban Roads		0.700	11.1	0.689	10.9	4.920	78.0	I-O
2	South Asia (LMIC)	India (West Bengal)	Simulation - Rural Roads		2.188	28.5	0.686	8.9	4.804	62.6	I-O
2	South Asia (LMIC)	India (West Bengal)	Simulation - Other		0.868	13.2	0.750	11.4	4.974	75.5	I-O
3	South East Asia (LMIC)	Indonesia	Fiscal Stimulus Package (Varied Projects)	293 000							DySAM
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Roads	49							DySAM
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Roads	24							DySAM
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Irrigation	24							DySAM
3	South East Asia (LMIC)	Indonesia	Simulation - Construction: Other	30							DySAM
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Employment Intensive Approach to Infrastructure	67 601	16654		50947				I-O
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Conventional Approach to Infrastructure	42 878	3798		39079				I-O
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Employment Intensive Approach to Infrastructure	41 826	10870		30957				I-O
4	Sub Saharan Africa (LIC)	Liberia	Simulation - Conventional Approach to Infrastructure	13566	2507	18.5	11060				I-O
4	Sub Saharan Africa (LIC)	Ghana	Social Housing Assessment	2883	1197	41.5	858	29.8	837	29.03	SAM
4	Sub Saharan Africa (LIC)	Rwanda	Simulation	24600	16933	68.8					SAM
4	Sub Saharan Africa (LIC)	Rwanda	Simulation	10250	3034	29.6					SAM

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Country and programme or project information				Programme or project level employment information							
Region number	Global region	Country	Project / Programme	Total FTE year jobs - (Direct Jobs + Indirect Jobs + Induced Jobs)	Total Number of Direct Jobs	Direct % - (Direct Jobs/ Total JobsJ)	Total Number of Indirect Jobs	Indirect % - (Indirect Jobs/ Total Jobs}	Total Number of Induced Jobs	Induced % - (Induced Jobs/ Total Jobs}	Type
5	UMIC	Turkey	Simulation	1800.95	610	15.3	2250	56.5	1120	28.1	I-O
5	UMIC	Turkey	Simulation	4180	640	15.3	2700	64.6	840	20.1	I-O
6	HIC:Non-OECD	Latvia	Simulation	3 750	520	13.9	1970	52.5	1260	33.6	I-O
6	HIC:Non-OECD	Latvia	Simulation	3 090	610	19.7	1330	43.0	1150	37.2	I-O
6	HIC:Non-OECD	Lithuania	Simulation	4 330	550	12.7	2530	58.4	1250	28.9	I-O
6	HIC:Non-OECD	Lithuania	Simulation	5 360	830	15.5	3180	59.3	1350	25.2	I-O
6	South East Asia (HIC:Non-OECD)	Taiwan	Simulation	4 240	490	11.6	2150	50.7	1600	37.7	I-O
6	South East Asia (HIC:Non-OECD)	Taiwan	Simulation	5 130	730	14.2	2840	55.4	1560	30.4	I-O
7	HIC:OECD	Greece	Simulation	2 650	290	10.9	1220	46.0	1140	43.0	I-O
7	HIC:OECD	Greece	Simulation	2 850	450	15.8	1380	48.4	1020	35.8	I-O
7	HIC:OECD	Hungary	Simulation	3 650	530	14.5	2090	57.3	1030	28.2	I-O
7	HIC:OECD	Hungary	Simulation	4 290	580	13.5	2710	63.2	1000	23.3	I-O
7	HIC:OECD	Ireland	Simulation - Roads (Construction)	13 983	8 773	62.7	3349	24.0	1861	13.3	I-O
7	HIC:OECD	Ireland	Simulation - Roads (Improvements)	15 145	10 267	67.8	2 862	18.9	2 016	13.3	I-O
7	HIC:OECD	Ireland	Simulation - Rail	12 858	8146	63.4	3001	23.3	1711	13.3	I-O
7	HIC:OECD	Ireland	Simulation - School	14 936	7 798	52.2	5 150	34.5	1 988	13.3	I-O
7	HIC:OECD	Ireland	Simulation - Hospital	14 522	7286	50.2	5303	36.5	1933	13.3	I-O
7	HIC:OECD	Ireland	Simulation - Social Housing	15 836	8912	56.3	4 816	30.4	2 108	13.3	I-O
7	HIC:OECD	Ireland	Simulation - Drinking/ Wastewater Treatment	12 823	6266	48.9	4 850	37.8	1 707	13.3	I-O
7	HIC:OECD	Ireland	Simulation - High Volatage Power Line	17 411	9525	54.7	5569	32.0	2 317	13.3	I-O
7	HIC:OECD	Ireland	Simulation - Gas Power Station	10 173	2757	27.1	6 062	59.6	1 354	13.3	I-O
7	HIC:OECD	Japan	Simulation	1 920	250	13.0	820	42.7	850	44.3	I-O
7	HIC:OECD	Japan	Simulation	2 330	250	10.7	1050	45.1	1030	44.2	I-O
7	HIC:OECD	Poland	Simulation	4 370	600	13.7	2100	48.1	1670	38.2	I-O
7	HIC:OECD	Poland	Simulation	4 020	690	17.2	1970	49.0	1360	33.8	I-O
7	HIC:OECD	USA	Energy	1 667							I-O
7	HIC:OECD	USA	Transportation	1 887							I-O
7	HIC:OECD	USA	School buildings	1 923							I-O
7	HIC:OECD	USA	Water	1 961							I-O
7	HIC:OECD	USA	Simulation	2 100	230	11.0	820	39.0	1050	50.0	I-O
7	HIC:OECD	USA	Simulation	1 770	190	10.7	740	41.8	840	47.5	I-O
			Max			68.8		70.2		78.0	
			Min			10.4		6.9		9.2	
			Average			28.9		39.2		32.6	

Emergency employment

Local resource-based approaches and community infrastructure

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