Tionscadal Éireann
Project Ireland
2040

Public Capital programme 2021 – 2030: Labour Intensity of Public Investment

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Summary

This paper examines the labour market impacts, specifically the labour intensity, in Ireland in various areas of public capital investment, with a particular focus on construction. The labour intensity analysis in this paper is based on **CSO data sources** i.e. Input-Output table, Labour force Survey data. This builds upon a similar IGEES analysis published by the Department of Public Expenditure and Reform in 2015.

The estimates are for **direct and indirect jobs.** For example, in construction a directly sustained job is an increase in on-site construction work; and an example of indirectly sustained job is employment in the cement manufacturer supplying the construction site. Induced jobs are not included in the analysis; for example jobs in local shops and restaurants used by employees of the construction firm and the cement manufacturer. Similarly, the 'catalytic' impacts of investment are also out of scope. This includes jobs that arise from economic growth opportunities caused by better economic and social infrastructure.

The paper estimates that for a €1 million increase in construction expenditure, direct and indirect employment (employed and self-employed) in construction will increase by approximately 8 job years. Therefore, if a construction project worth €10 million lasts for one year then it supports around 80 construction jobs for a one-year period.

The analysis estimates that on average approximately 80,742 construction jobs will be sustained per year as a result of public investment over the period of 2021 and 2030.

There are a number of **caveats and limitations**, so results should be interpreted with caution.
1. The NDP sets Departmental capital allocations for 2021-2025 and total capital ceilings for 2021-2030. The figure of 80,742 construction jobs is based on an assumption that the share of capital allocations across Departments remains constant post-2025.
2. The analysis does not distinguish between existing jobs that are sustained and new jobs created.
3. The analysis does not distinguish between the types of jobs sustained i.e. High-skilled, semi-skilled, low-skilled.
4. The estimates presented in this analysis relate to jobs supported in Ireland only. However, some sectors have high imports and therefore this is reflected in the low estimates of job impact.
5. There are many different types of construction. However, only one construction multiplier has been utilised for the final jobs multiplier calculations.
6. The assessment of job creation is made using a number of data sources. The latest CSO Input-Output table dates back to 2015 while other CSO data sources are from 2019.
7. Elevated levels of tender price inflation in Ireland over the last number of years means that any indicators constructed from 2015 Input-Output data are likely to slightly overestimate the current impact.
8. This type of analysis focused on the demand side only and doesn't take account of the supply side of labour.

Section 1:

Introduction

Public capital investment is critical to enhancing the economy's future growth potential, responding to demographic changes, meeting the essential requirement for balanced regional growth, supporting the societal transformation required to achieve climate action objectives, increasing productivity and strengthening the economy's resilience to major risks such as Brexit.[1]

The short-term benefit from capital investment includes employment creation.[2] Understanding the relative labour intensities of public capital expenditure in various sectors can help to verify the robustness of business cases and their assertions about short term job creation. This allows to compare the relative potential labour impact between investments in different sectors.[3] In presenting a new National Development Plan, therefore, it is useful to provide evidence on the employment intensity arising from both construction projects and other categories of capital spend within the investment programme. Having information about the labour intensities of various types of capital-funded activity gives an insight into the impacts of Government expenditure and also facilitates comparisons between projects and sectors.

This paper examines the labour markets impacts, specifically the creation of jobs, in Ireland in various areas of public capital investment, with a particular focus on construction. Essentially, the paper explains the calculation carried out to estimate the number of jobs associated with Government spending on capital projects. The labour intensity analysis in this study is based on Input-Output data from the Central Statistics Office (CSO) and other CSO data sources. The intensities reported are estimates of the potential job impacts.

It should be noted that the estimates outlined in this paper are for direct and indirect jobs. For example, in construction, a direct job is an increase in on-site construction work; and an example of indirect jobs is employment in the cement manufacturer supplying the construction site. Induced jobs are not included in the analysis; for example jobs in local shops and restaurants used by employees of the construction firm and the cement manufacturer. Additionally, 'catalytic' impacts of investment

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[1] Review of the Capital Plan 2016 - 2021
[2] Strategic Public Infrastructure (2017)
See also: 3 Bonn, P. and J. Ligthart (2014), "What Have we Learned from Three Decades of Research on the Productivity of Public Capital?", Journal of Economic Surveys, Vol. 28, No. 5, 889-916.
[3] Department of Public Expenditure and Reform (2015) Building on Recovery: Infrastructure and Capital Investment 2016-2021

are also out of scope. This includes jobs that arise from economic growth opportunities caused by better economic and social infrastructure. [4]

Section 2:

Existing research

Estimating the labour intensity of Government capital expenditure in Ireland has been carried out previously, most recently in the context of the 2015 Capital Plan.[5] This paper uses the same methodology with some minor adjustments to make similar estimates for the NDP 2021 – 2030. The paper accompanying the 2016-2021 Capital Plan found that a €1 million increase in construction expenditure sustains approximately 12 job years. For non-construction capital investment, such as in transport vehicles, machinery and computers, the analysis estimated that for every €1 million invested in capital goods, direct and indirect employment would increase by between 0.05 and 3 job years. This reflected the high import level and low Irish labour contribution of these products. However, it was estimated that for every €1 million spent on repair/maintenance and installation, direct and indirect employment would increase by between 8 and 10 job years. Overall, it was expected that more than 45,000 construction-related jobs would be sustained over the lifetime of that capital plan.

A previous paper by the Department of Finance (2009), Labour Intensity and Infrastructure Investment, collated and analysed data from a number of sources to aid comparison of the impacts of capital investment across a number of sectors. This work undertook a survey of Government Departments and found that the labour intensity of capital projects had a range of 8-12 direct jobs per €1 million of expenditure. This estimate was supported by a review of international literature.

A paper by DKM Consultants and the Construction Industry Federation applied estimated labour intensity factors to the value of construction output in the period 2017-2020. This provided indicative estimates for the future level of direct and indirect construction employment. Using the CSO Quarterly National Household Survey, they estimate that four in every ten persons in a construction project are employed 'indirectly' through supporting industries such as suppliers. There were 136,900 persons directly employed in construction in Q2 2016, which would imply a total of almost 192,000 direct and indirect jobs in construction. In the DKM paper, it was calculated that 12 construction jobs would be

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[4] See explanation in caveats and limitation section for why only direct and indirect jobs are calculated and not induced jobs. (See Caveats and limitation No:8).
[5] Public Capital Programme 2016 to 2021 - Labour Intensity of Public Investment

sustained per €1 million investment in 2016. This reduces to 11 jobs per €1 million for every year between 2018 and 2020.[6]

The Scottish Government also produced a Construction jobs multiplier to estimate the effects of Government capital spending in Scotland. The method that they used for calculating the jobs multiplier included assessment of the impact on the suppliers of the company (direct and indirect) and effects on the economy due to an increase in the spending of employees (induced jobs).[7] The study was carried out in 2015 utilising Scotland's Input Output tables. The paper outlines that the Construction indirect and direct jobs multiplier is 14.2, while the induced jobs multiplier is 16.57. Their employment multiplier estimates the number of indirect or induced full time equivalent employees as a result of a direct change of 1 full time equivalent employee generated by the final demand sector. The results were for three years and are as follows; £170m of economic output within the construction industry, its supply chains and spending on wages and salaries. Additionally, £45m over the three years of income generated within the construction industry, its supply chains and spending on wages. Overall, around 400 full time equivalent Scottish jobs within the construction industry and its supply chain plus a further 65 full time equivalent jobs when the spending of wages and salaries is taken into account.[8]

Another paper titled 'The Employment Benefits of Investment projects' was prepared by AECOM, on behalf of the National Roads Authority. One of the methodologies identified in the paper involved evaluation of employment effects of potential investment projects. The methodology involves the selection of a representative range of construction projects. For each project, the level of employment is evaluated. This includes the level of direct employment (people employed on the project), indirect employment (people employed in the supply of goods or services to the project) and induced employment (the additional employment generated due to the increase in consumption as a result of the direct and indirect employment increases). The direct and indirect employment effect is studied through the Input-Output tables produced by the CSO. The induced employment effect is estimated though the calculation of marginal propensity to consume i.e. the proportion of any extra income earned by Irish employees that would be spent, rather than taxed or saved. The estimates of the direct and indirect extra wages and salaries arising from the potential projects already calculated were multiplied by this marginal propensity to consume to give estimates of extra consumer spending. The conclusion of the paper are as follows; firstly, when all effects are included, the projects that have high

[6] Demands for Skills in Construction to 2020 (page 59)
[7] Scottish Government - Supply, Use and Input-Output Tables
[8] Input-Output based economic multipliers (Page 7)

traditional construction content have the largest employment effects in comparison to projects with a high technology and equipment content i.e. social housing construction multiplier was 13.7 while drinking/waste water treatment construction multiplier was 11.1. Secondly, there are reasonably significant differences between the levels of direct employment generated by potential investment projects in different sectors. These differences are reduced when indirect and induced employment effects are included.[9]

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[9] The Employment benefits of Investment projects (2013) by AECOM (on behalf of National Roads Authority)

Section 3:

Methodology

This section sets out the methodology to calculate the jobs multiplier as well as outlining the definitions, assumptions, caveats and limitations.

The CSO's Input-Output Table and Leontief Multiplier data are a useful tools to determine the number of direct and indirect job years sustained as a result of expenditure in economy. The method to calculate the jobs multiplier per €1 million expenditure is as follows; firstly, using information (such as total imports, total domestic supply, total exports) from the I-O table, the share of domestic production that is not exported is calculated for the particular category of spend e.g. Construction. Secondly, this share is multiplied by €1 million euros (calculating the jobs sustained for €1 million euro spent in the economy), to obtain the additional domestic supply (in €) in the economy. Thirdly, this additional domestic supply is multiplied by the Compensation of Employees (CoE) multiplier to obtain the estimated increase in CoE i.e. the amount of money allocated to employees' wages in the sector. Fourthly, this estimated increase in CoE is divided by the Average Labour Cost to obtain the number of direct and indirect jobs sustained as a result of €1 million of expenditure in the economy, this is the jobs multiplier.

It is important to note that the analysis is illustrative in that it looks at expected or likely labour impacts, rather than calculating jobs utilising actual labour market data, with the exception of calculating the self-employed construction job multiplier. Formulas utilised for the calculation are outlined in a detailed manner in the Appendices; Appendix One (for sectors such as repair of machinery, ICT, etc.), Appendix Two (for construction subsectors), Appendix three (for the construction multiplier), Appendix four (for construction self-employed multiplier).

The rest of this section outlines the definitions, the assumptions, and the caveats and limitations of the analysis.

Definitions

Direct/Indirect/Induced Impacts

Table 1 illustrates the different types of employment channels. Direct employment refers to the employment engaged to produce a final product (e.g. construction products such as buildings).

Indirect employment refers to employment required to produce the intermediate inputs into the final product (e.g. prefabricated concrete blocks). Induced employment occurs as a result of growing demand arising from increased consumption owing to the increase in direct and indirect employment. The multipliers constructed by the CSO are for the direct and indirect impacts only; any induced impacts are not included.

Table 1: Illustration of Multipliers

Effect	Impact in Economy	Examples of jobs
Direct	The increase in supply of the final product demanded	Increase in on-site construction work
Indirect	Increase in the rest of the supply chain for intermediate goods that go towards the production of the final product demanded	Increase in jobs in cement manufacturer supplying the construction site
Induced	The wider impact in the rest of the economy as a result of increased incomes from those directly and indirectly employed as a result of increased production	Increase in jobs in local shops and restaurants used by employees of the construction firm and the cement manufacturer.
Catalytic	Impacts on other sectors or areas of the economy	Increase in competitiveness from lower trade costs caused by better national and international transport connectivity.

Input- Output (I-O) Table

This table shows the use made of domestically produced products in the production of other products. It presents information such as total domestic production, imports of final goods, exports of final goods etc. Overall, Supply and Use Tables and Input-Output Tables provide a detailed picture of the transactions of goods and services by industries and consumers across the Irish economy in a single year. Additionally, they take into account the inter-industry flows.[10] The I-O table is utilised for the job multiplier calculations.

The Leontief-Multiplier

The CSO produces Leontief multipliers that are derived from the Domestic Input-Output table. These multipliers show the overall increase in direct and indirect demand in the rest of the Irish economy that arises from an increase in final demand of a domestically-produced good or service. It is

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[10] Supply and Use and Input-Output Tables for Ireland (2015)

noteworthy that the Leontief multipliers look at the direct and indirect multiplier, but not the induced multiplier. The compensation of employee variable and Net Operating Surplus is found in the Leontief Multiplier table.

- **Compensation of Employees (CoE) -** The COE[11] variable, found in the Leontief table, indicates by how much the total compensation of employees' increases as demand in a sector rises. In simpler terms, the COE is 0.29 for the construction sector which means that for every one euro spent, 29 cents are earned by the employed. It is noteworthy that COE in the I-O table only includes the compensation of people who are employed by firms but does not include those who are self-employed. It is assumed that the increase in CoE will lead to an increase in jobs in proportion to the average labour cost in the particular area of activity. For example, if the average labour cost in an area of activity is €50,000 and the total compensation of employees increases by €100,000 due to an investment of €1 million, and where all the investment is in domestically produced final goods, then the analysis suggests that two jobs are sustained as a result of the investment. In reality though, different sectors/areas and, indeed, firms will respond differently, and it depends in large part on the nature of the industry. Some industries may have spare capacity and so there may not be any increase in labour required. Others may deliver the increased demand with overtime. Actual sectoral responses to public capital investment may reflect the nature of any investment and its anticipated longevity. In order to address this issue, the Leontief table estimates the COE for all NACE sectors.
- **Net Operating Surplus (NOS) –** Gross operating surplus by industry is the balance that remains after deducting from the value added (basic prices) the compensation of employees and the balance of other taxes and subsidies on production. The operating surplus of the self-employed is called mixed income because it also contains compensation for work by the owners and their family members. For example, NOS for construction sector is 0.18, implying that for every one euro spent, 18 cents are earned in profits (of the employed and other firms). Appendix 4 shows how the profits of the self-employed and the profits of the firms were separated in order to calculate the full-time equivalent jobs for the construction sector for the self-employed.

Job-Years

Where capital projects have an expenditure profile over a number of years it may be appropriate to reflect the numbers of jobs sustained or to refer to them as job-years. The analysis presented in this paper estimates that for a €1 million increase in construction expenditure, direct and indirect employment in construction will increase by approximately 8 job years. For example, if a

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[11] Noteworthy that compensation of employees includes employers' contribution to social insurance and other labour costs.

construction project worth €10 million lasts for one year then it supports around 80 construction jobs for a one-year period. If a project worth €10 million lasts for two years then around 40 construction jobs would be supported for a two-year period. In both cases there would be 80 job-years supported by the investment.[12] Note that the job multiplier calculated in this paper are either direct or indirect jobs. The definition of direct, indirect and induced jobs are explained in Table 1. It is also vital to note that the analysis calculates full-time jobs as data for average full-time labour cost has been utilised for the multiplier calculations.

NACE code

NACE is the classification of economic activities in the European Union. The I-O table divides the economy into 58 NACE sectors.[13] For the jobs multiplier calculation, ten NACE sectors or categories of spending were examined, with a particular focus on code F for construction. The rationale for choosing these categories of spending is outlined in Appendix 6.

Domestic production and Expected Sourcing

The jobs multiplier has been calculated in two different ways (as can be seen in Appendix 6); the first calculation titled 'Results (all)' does not take any exports or imports into account. The second results 'Results for expected sourcing' eliminates exports and imports from final calculation as it is considering the products that are produced in Ireland for domestic use.

Treatment of Public Private Partnerships

Public Private Partnerships (PPPs) are partnerships between the public and private sectors for the purpose of delivering a project or service traditionally provided by the public sector. These partnerships tend to be long-term agreements (25 years +) which can take many contractual forms.[14] The NTMA is designated as the National Development Finance Agency (NDFA) when providing financial advice to State authorities undertaking major public investment projects with a capital value of more than €20m and when procuring and delivering Public Private Partnership (PPP) projects in sectors other than transport and the local authorities. The NDFA is responsible for delivering education, health, justice and housing PPP projects with an estimated total capital value of €1bn. Transport Infrastructure Ireland is responsible for procuring the various road PPP projects. The NDFA acts as financial advisor across the entire PPP programme. [15] For the purpose of this paper, data from NTMA was utilised. This included the proportion of PPP investment spent on construction,

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[12] The electrical equipment full-time equivalent multiplier is 0.10. This implies that a €10 million investment can potentially create 1 jobs.
[13] There are more than 58 possible codes But CSO currently works with an aggregate of 58 in the I-O tables.
[14] An Overview of Public private partnerships in Ireland
[15] National Development Finance Agency - Delivering of PPPs

maintenance, lifecycle and financial costs. A worked example of the treatment of PPPs can be found in Appendix 5.

Assumptions

Proportions

The seven departments that have the highest level of Capital Expenditure in 2021 are: Enterprise, Trade & Employment; Education; Environment, Climate & Communication; Further and Higher Education, Research, Innovation and Science; Health; Housing, Local Government & Heritage and Transport. These seven out of eighteen Government Departments make up 87% of the capital expenditure in 2021. The National Investment Office communicated with the aforementioned seven Departments and received an estimate of how each Department's capital expenditure is split for construction spending. For consistency and robustness, the National Investment Office decided a specific period for the proportions i.e. as Departments at that time only had Departmental allocations out to 2022, they were asked to calculate the proportions for the period 2018-2022. An example is outlined in Appendix 5. It was then assumed that this proportion would remain the same over the period of the NDP 2021 – 2030.

Caveats and Limitations

A number of caveats and limitations should be borne in mind when considering the results of the labour intensity of capital investment:

1. 'Labour intensity' refers to jobs supported through the undertaking of the capital projects. It is difficult to distinguish between existing jobs that are sustained and new jobs created. For the purpose of this paper, we have denoted that the jobs are sustained rather than created.

2. The estimates presented in this analysis relate to jobs supported in Ireland only. Some sectors may have a high import content and this is reflected in the low estimates of job impact.

3. The paper doesn't comment on the types of jobs that were sustained i.e. High skilled, Low-Skilled etc. In other words, quality of the jobs were not assessed.

4. There are many different types of constructions i.e. construction of roads and railways, construction of residential and non-residential buildings etc. this can be found in the sub-sector of construction section in this paper. However, only one construction multiplier has been utilised for the final jobs multiplier calculations.

5. The assessment is made using a number of data sources: Business demography (CSO), Input-Output table 2015, Average Earnings (CS0). Additionally, the latest I-O table and Leontief multiplier was for 2015 while the other data such as average full-time labour costs etc. is available

for 2019. As a number of different sources and years are combined to produce the results, they should be interpreted with caution.

6. Over time, due to price inflation in the economy the State can purchase less with the same level of money. In general, it would be expected that, for €1 million of investment, the jobs impact will decline over time. Elevated levels of tender price inflation in Ireland over the last number of years[16] means that any indicators constructed from 2015 Input-Output data are likely to slightly overestimate the current and future impact of expenditure.

7. The analysis here only calculates the direct and indirect jobs, not induced jobs. This is as a result of CSO Leontief multiplier accounting for only direct and indirect jobs. Additionally, the analysis does not take account of the "catalytic" impacts – these relate to longer-term economic and productivity growth caused by an improvement in the stock of public capital.

8. While an R&D multiplier is calculated in section 4 of this paper using CSO I-O data, a number of issues were identified when seeking to apply this to public capital expenditure in this area. In particular, job creation itself is often a key objective of public expenditure related to R&D through agencies/bodies such as Enterprise Ireland, implying an inherent bias. For example, Enterprise Ireland uses real-time data to calculate the number of jobs i.e. in 2019, 16,971 jobs were created from an annual spend of €403 million, or 42 jobs per €1 million. This is significantly higher than the multiplier calculated in this paper (3.6 jobs per €1 million) which relates to capital expenditure on R&D across the entire economy. Therefore, the R&D multiplier was not used to calculate the number of R&D jobs created from public investment. The focus of the paper has remained on the construction sector which is unlikely to be affected by the same bias since expenditure in that area is not driven by a goal of job creation.

9. This type of analysis focuses on the demand side only and doesn't take account of the supply side, in this case whether there will be adequate pools of labour available.

10. By using data from aggregate national accounts, the estimates are based on the average rather than the marginal impact of expenditure. This means that this type of analysis doesn't take account of displacement in the labour market. For example whether, in the absence of this level of funding a share of the workers would be employed on projects funded by the private sector or employed in other sectors of the economy.

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[16] Build 2020: Construction Sector Performance and Capacity

Section 4:

Results

The categories of capital activity chosen for this analysis capture the types of capital investment that the Government typically undertakes. These are construction, machinery & Equipment, Repair/installation of machinery and equipment, ICT/Computer consultancy.

Table 2 below shows the estimated direct and indirect full-time jobs sustained per €1 million expenditure. The first column states the sector of the capital allocation while column two matches the sector with CSO NACE Sector. Column three outlines the results that were produced in the 2015 paper[17] and column four outlines the current results. The results can be read as follows; for every €1 million in capital expenditure, the number of direct and indirect construction jobs would potentially increase by 7.8 job years. As would be expected due to inflation, the number of direct and indirect (FTE) jobs created per €1 million of capital expenditure has reduced for all sectors compared to 2015 (with the exception of computers& electronics).

The 2015 paper estimated that a €1 million investment in 'Construction' will create 12 direct and indirect jobs, utilising the 2011 I-O table. In this paper, it is estimated that a €1 million investment in 'Construction' will sustain approximately 8 direct and indirect jobs, utilising the 2015 I-O table. The difference in the construction multipliers between the 2015 paper and this paper can be explained through the CoE variable, which decreased significantly between 2011 and 2015 i.e. from 60 cents in 2011 to 30 cents in 2015. This implies that for every euro invested in the Construction sector, employees earned 60 cents according to the 2011 I-O table, while they earned 30 cents according to 2015 I-O table. Additionally, the multiplier is higher for the period after recession. Furthermore, the 2015 tables represents a more sustainable industry, in comparison to 2011 tables, as a result of the financial crash.

The 2015 paper estimates that a €1 million investment in 'Repair and Installation' will sustain 8 direct and indirect jobs, utilising the 2011 I-O table. With the use of the 2015 I-O tables, a €1 million investment in 'Repair and Installation' sustains 4.75 direct and indirect jobs. It is important to reiterate that the same methodology was utilised to calculate the jobs sustained. An explanation for this difference is that in the 2015 I-O table, for the 'Repair and Installation' category, 46 cents for every one euro spent was allocated to compensation of employees, i.e. salary, and approximately 40 cents

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[17] Public Capital Programme 2016 to 2021: Labour Intensity of Public Capital (2015)

was spent on imports. However, in the 2015 I-O table, approximately 30 cents for every €1 are earned/salary while approximately 50 cents for every €1 are spent on imports. Overall, in the 'Repair and Installation' category, a higher amount is being spent on imports and less on COE, when comparing the 2011 and 2015 I-O tables.

For Research and Development, the Scientific Research and Development data from the I-O table was utilised. It is important to note that two multipliers were calculated; firstly a domestic multiplier and secondly a multiplier (expected sourcing) which takes imports and exports into account. Detailed descriptions of these two multipliers can be found in section 2 of this paper. Appendix 6 shows the results for the two R&D multipliers; 3.6 for domestically produced and 0.003 for results with expected sourcing).

Table 2: Estimated direct & indirect jobs (FTE) per €1 million additional expenditure for Selected Sectors

NACE Sector	Number of direct and indirect jobs (FTE) per €1 million additional expenditure (adjusted for imports)	
	2015 Analysis [18]	2021 Analysis
Construction and construction works	12	7.8
Petroleum; furniture; other manufacturing	0.3	0.04
Fabricated metal products	3	1.5
Electrical equipment	0.1	0.1
Machinery and equipment	0.05	0.04
Motor vehicles, trailers and semitrailers	0.3	0.09
Repair/installation of machinery & equipment	8	4.75
Computer, electronic & optical products	0.02	0.04
Computer consultancy; data processing	2	1.04
Architectural and engineering services	10	8.1
Research and Development	N.A	3.6
Legal Activities	N.A	6.5

Note: For the purpose of presentation, there is some rounding in the table.

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[18] Public Capital Programme 2016 to 2021: Labour Intensity of Public Capital (2015)

Subsectors of Construction

Relative intensities for construction sub-sectors were calculated using additional CSO data and then applied to the overall job intensity for the overall construction sector. The results can be found in Table 3 below. The calculations and sources of data are explained and outlined in the Appendix 2.

It is seen, from Table 3, that 'building completion and finishing' produces the highest full-time equivalent jobs within construction. This involves painting, tiling and interior. On the other hand, 'development of building projects' produces the lowest full-time equivalent jobs within construction. This sub-sector involves residential and non-residential building projects bringing together financial, technical and physical means to realise the building projects for later sale.

Table 3: Estimated Additional Construction Jobs per €1 million Additional Expenditure: Direct and Indirect, Full-Time Equivalent

	2015 Analysis	Current Analysis
Construction Overall – (As calculated in Appendix 4)	**12**	**7.8[19]**
Breakdown by Sub-sectors of Construction:[20]		
Development of building projects	N.A	1
Construction of residential and non-residential buildings	10	5
Construction of other civil engineering projects	N.A	6
Construction of roads and railways	7	7
Demolition and site preparation	13	8
Construction of utility projects	7	8
Electrical, plumbing and other construction installation activities	10	11
Other specialised construction activities	N.A	12
Building completion and finishing	20	13

Note: For the Purpose of presentation, there is some rounding in the table.

Note: Labour intensity of Self-employed was not calculated for subsectors of Construction.

Note: N.A means non- applicable as this sub-sector's labour intensity was not calculated in the 2015 paper.

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[19] To note that the 7.8 jobs multiplier includes self-employed and employed.
[20] Note that the multiplier for subsector includes self-employed and employed.

Section 5:

Conclusion

This paper highlights the variations in labour intensities in Ireland across and within sectors and areas of capital expenditure. By definition, capital infrastructure projects are relatively short-term and once-off, with associated jobs occurring during the construction or implementation phase of a project. For every €1 million increase in construction expenditure, direct and indirect employment in construction will increase by approximately 8 job years, while that figure varies for construction sub-sectors.

The new National Development Plan sets out the Departmental capital allocations for 2021 – 2025 alongside the total capital ceilings out to 2030. In order to calculate the number of construction jobs that will be sustained over the entirety of the NDP it is assumed that the share of capital allocations across Departments will remain constant post 2025. Based on this, and using the construction multiplier, it is calculated that an annual average of approximately 80,742 construction job years will be sustained during the NDP.

Future research in this area might examine in closer detail the variation in job creation between public investment and private investment when it comes to R&D expenditure.

Finally, updating the multipliers in 2022, when the new IO tables are published, will give more up-to-date figures and perhaps demonstrate the impact that inflation may have had over the intervening years.

Appendix

Appendix 1 - Illustration of Methodology: Expected Sourcing

As the multipliers produced by the CSO refer to final goods and services produced domestically, additional analysis has been conducted to estimate the likely jobs intensity from elements of the capital programme that will be comprised of capital goods that are imported and produced domestically. The calculation below reflects the potential job estimates from domestic production and the jobs impact adjusted for both imports and exports.

Step 1: From the Input-Output table, we see that two in three or 66% Electrical Equipment is imported.			
Total domestic production, €m	1,062	A	Source: Input Output Table
Imports of final goods, €m	2,036	B	
Total Supply of final goods, €m	3,099	C	
Exports of final goods, €m	1,003	D	
Expected domestic production of total domestic supply, %	0.028	E	(A-D)/(C-D) *100 OR ((Domestic Supply-Exports) /(Total Supply - Exports))*100
Step 2: If €1 million is spent on Electrical Equipment, then according to the calculation, on average, €28,148 to be spent on Electrical Equipment that is produced domestically.			
Estimated additional domestic Supply as a result of increased spend of €1 million	€28,148	F	€1 million * E (Percentage of expected domestic production)
Step 3: From the 'Direct and indirect multiplier for other inputs', the multiplier for the Compensation of Employees is 0.216. So for the additional domestic supply resulting from the increased demand of €1 million, there will be an estimated increase in Compensation of Employees of €6,080:			
Compensation of employees multiplier (direct and indirect)	0.216	G	Leontief Table 2015. Source: CSO
Estimated increase in Compensation of employees due to additional €1m in purchases	€6,080	H	F*G
Step 4: Average labour cost for a full-time equivalent in the Manufacturing sector was €59,794 in 2019			

Average Labour Cost (2019)	€57,790	I	Source: CSO Databank
Share of Full-time labour (2019)	93%	J	Source: CSO Databank
Share of Part-time labour (2019)	7%	K	Source: CSO Databank
Average FTE Labour Cost	€59,794	L	I/(J+K/2)
Step 5: Dividing the estimated increase in total Compensation of Employees by the average full-time equivalent labour cost gives the estimated additional number of direct and indirect jobs in the sector in question:			
Number of direct and indirect jobs (FTE) per €1 million additional expenditure	0.10	M	H/L
Explanation of the result: For every €1 million increase in electrical equipment capital spending, direct and indirect jobs increased by approximately 0.10 job years.			

Source: CSO Databank, DPER Calculations

Note: For the Purpose of presentation, there is some rounding in the table.

Appendix 2 - Illustration of Methodology: Sub-sectors of Construction

The following sub-sectors of construction were chosen from the CSO list of sub-sectors. The following shows an example of how the full-time equivalent jobs is calculated for the 'Building, completion and finishing' was calculated.

The following pieces of information, we received from CSO website. It is important to note that the data was used for 2017 due to full data availability.

The following shows an example of how the full-time equivalent jobs was calculation for the 'Building, completion and finishing' was calculated.			
Step 1 – Information obtained from CSO databank and calculate per person turnover.			
Turnover €m	3,503	A	This is the turnover for the 'Building, completion and finishing' subsector.
Number of persons engaged	32,004	B	This is the number of people working in the sub-sector.
Per person per million turnover	9.14	C	This is obtained by dividing B/A. Persons engaged divided by turnover i.e. Per person per million turnover.
Step 2 – Calculating sub-sector intensities as ratio for total construction and number of FTE jobs for the sector in question.			
Total Construction Per person per million turnover	5.52	D	Calculated by dividing total turnover for all 9 sub-sectors of construction by number of persons engaged in all 9 subsectors.
Subsector intensities as ratio to Total Construction	1.66	F	C/D. This is Subsector intensities of 'Building, completion and finishing subsector' as ratio to Total Construction
Number of direct and indirect jobs (FTE) per €1 million additional expenditure	7.8	G	This is the number of FTE jobs sustained for the construction sector. The methodology can be seen in Appendix 3 and 4.
Number of FTE jobs in the 'Building, completion and finishing' subsector.	12.95	H	F*G
It is estimated that there will be 12.95 jobs sustained per 1 million investment in the 'Building, completion and finishing' subsector.			

Source: CSO Databank, DPER Calculations

Note: For the Purpose of presentation, there is some rounding in the table.

Appendix 3 - Illustration of Methodology: Construction Sector Multiplier without the self-employed

The following shows the calculation for the construction sector. The Construction sector does not include expected sourcing (imports/exports) in the Calculation as while many inputs to construction are imported, the construction activity must by necessity be 'produced domestically'. It is important to mention that the following calculation looks at the jobs sustained per €1 million for the employed.

If an additional €1 million is spent on construction:			
Additional construction Demand	1,000,000	A	Additional demand (hypothetical).
Step 1: From the Leontief Table (CSO), the multiplier (for indirect and direct jobs) for the compensation of employees is 0.29. To re-iterate, this implies that for every €1 euro spent in the economy, 29 cents, on average, are earned by the employed.			
Compensation of employees multiplier (direct and indirect)	0.29	B	Leontief Table – CSO
Estimated increase in Compensation of employees due to additional €1m in purchases	€292,800	C	A*B
Step 2: Average labour cost for a full-time equivalent in the Construction was €49,206.			
Average Labour Cost (2019)	€46,891	D	CSO Databank
Share of Full-time labour (2019)	91%	E	CSO Databank
Share of Part-time labour (2019)	9%	F	CSO Databank
Average FTE Labour Cost	€49,206	G	D/(E+(F/2))
Step 5: Dividing the estimated increase in total Compensation of Employees by the average full-time equivalent labour cost gives the estimated additional number of direct and indirect jobs in the sector in question:			
Number of direct and indirect jobs (FTE) per €1 million additional expenditure	5.95	H	(C Divided by H) OR Total increase in compensation divided by Average FTE Labour cost
Explanation of the result: For every €1 million increase in Construction, direct and indirect jobs in Construction increased by approximately 5.95 job years.			

Source: CSO Data, DPER Calculations

Note: For the Purpose of presentation, there is some rounding in the table.

Appendix 4 – Illustration of Methodology: Construction sector multiplier including the self-employed.

The calculations below show the multiplier calculation for the construction sector for the self-employed.

Part A

Step 1: Information – Source: CSO Databank			
Number of Employees in Construction	146,975	A	Source: CSO Data
Number of Self-employed in C	45,709	B	A*31.1% as CSO Data states that 31.1% of those employed in Construction are self-employed.
Average Employee Wage	47,402	C	Source: CSO Data
Average Self-employed wage	47,402	D	Assumption - Self-employed earn the same as employed.
Step 2: To calculate overall net mixed income[21] by overall Compensation of Employees (CoE)			
Wage of self-employed person divided by wage of employee (Proportion of wage self-employed to employed)	1	E	D/C
Number of self-employed divided by employees (Proportion of number of self-employed to employed)	0.311	F	B/A – Self-employment is 31.1% of the number of total employment.
Net mixed income of self-employed as a proportion of CoE	0.311	G = F/E	This result shows that 0.311 or 31.1% of the total amount earned by the employed proportion of the sector would be, on average, earned by the self-employed proportion of the sector.
Step 3: Model net operating surplus of firms and net mixed income.			

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[21] Net mixed income is the profits of the self-employed. In the I-O table, net operating surplus accounts for the Net mixed income and the profits earned by firms. Therefore, the following step deduces a method to separate NMI from the Net Operating Surplus.

Compensation of Employees	0.29	H	Source: IO Table 2015. This means that approx. 29 cent for every euro spent is the wages of an employee.
Net Mixed income/ Compensation of the self-employed in Construction.	0.09077	I	(H*G **OR** 0.29 * 0.311). Explanation: This means that for every one euro spent, 9 cents is the profit of the self-employed. Note: The profit of the self-employed are their wages.

Part B

Using the 0.09077, we can use it to calculate the number of Full-time equivalent self-employed jobs that will be generated in the construction sector. This calculation is as follows;

If an additional €1 million is spent on construction:			
Additional construction Demand	1,000,000	A	Additional demand (hypothetical).
Step 1: From the Leontief Table (CSO), the multiplier (for indirect and direct jobs) for the compensation of employees is 0.29.			
Mixed income multiplier (direct and indirect)	0.09077	B	Calculated in Part A of Appendix 4. Estimated using aggregate shares of GMI and Leontief Table – CSO.
Estimated increase in Compensation of employees due to additional €1m in purchases	€90,770	C	A*B
Step 2: Average labour cost for a full-time equivalent in the Construction sector was €49,206.			
Average Labour Cost (2019)	46,891	D	CSO Databank
Share of Full-time labour (2019)	91%	E	CSO Databank
Share of Part-time labour (2019)	9%	F	CSO Databank
Average FTE Labour Cost	49,206	G	D/(E+(F/2))
Step 5: Dividing the estimated increase in total Compensation of Employees by the average full-time equivalent labour cost gives the estimated additional number of direct and indirect jobs in the sector in question:			
Number of direct and indirect jobs (FTE) per €1 million additional expenditure	90,770/49,206 =1.8	H	C divided by H or Total increase in compensation divided by Average FTE Labour cost

Explanation of the result: For every €1 million increase in Construction, direct and indirect jobs in Construction increased by approximately 1.8 job years. We know from Appendix 3 shows that the employed jobs multiplier for the construction sector is 5.95 job years. Therefore, we can add the 5.95 + 1.8 = 7.8. This implies that for every €1m euro spent in construction sector, 7.8 full-time job years are sustained.

Note: For the Purpose of presentation, there is some rounding in the table.

Appendix 5 - Proportion Calculation

National Investment Office communicated with vote and their respective Departments to obtain construction proportions. The table below displays the proportions, obtained from the Education vote, for 2018 – 2022. It is also imperative to note that these proportions do not include Covid-19 funding. To re-iterate the period of 2018 to 2022 was considered as Department allocations and proportions were known for this period.

Year	Construction%	PPP%	Other %
2018	79.7	10.3	9.9
2019	78.7	10.2	11.1
2020	79.9	9.3	10.9
2021	85.4	9.7	4.9
2022	79.9	9.3	10.8
Average	80.72	9.76	9.52

Source: Education Vote, Department of Public Expenditure and Reform. Other includes expenditure on grants related to minor works and expenditure on ICT. Note: For the Purpose of presentation, there is some rounding in the table.

NDFA Data stated that 71% of the PPP costs were for construction, maintenance and operation for the Department of Education expenditure. Therefore 71% of the 9.5% PPP was added to the construction column, with the rest added to the other. The final proportions can be found in the table below.

Year	Construction %	PPP%	Other
2018	0.88	0	0.12

Note: For the Purpose of presentation, there is some rounding in the table.

Appendix 6 – Results

Table 4 looks at estimated additional direct & indirect jobs (FTE) per €1 million additional expenditure for selected sectors. The rationale column outlines why the particular NACE Code/spending category was utilised in the calculation. The results (produced domestically) column outlines the jobs that were sustained when exports and imports were not taken into account while results (for expected sourcing) outlines the number of jobs sustained when imports and exports are taken into account. The results can be read as follows; for every €1 million capital expenditure, the direct and indirect construction jobs would increase by 7.8 job years.

Table 4: Estimated additional direct & indirect jobs (FTE) per €1 million additional expenditure for selected sectors

Categories of spend	Rationale	Results (produced domestically)	Results (for expected sourcing)
Construction	This includes Construction of residential, non-residential buildings and utility projects, and civil engineering.	7.8 job years	7.8 job years
Machinery and Equipment	Calculation for non-construction capital investment in transport vehicles, machinery and computers.	0.7 job years	0.04 job years
Repair/installation of machinery and Equipment	Ancillary services, such as the repair and installation of machinery and computer consultancy, have also been included in the analysis as these form an important element of infrastructure delivery.	4.8 job years	4.8 job years
Information Communication Technology /Computer Consultancy	While a service, has been included because the roll-out of ICT infrastructure and systems will involve large elements of computer consultancy in its implementation and not just physical ICT infrastructure.	1.1 job years	1.04 job years
Electrical Equipment	Electrical Equipment	3.6 job years	0.10 job years
Architectural and Engineering Services	The sector includes work by engineering firms to provide planning, design, construction and management services for building structures, installations, civil engineering work and industrial processes.	8.3 job years	8.1 job years
Research and Development	Research and Development	3.6 job years	0.003 job years

Appendix 7 – Proportions and Total Results

The estimated construction related share was provided by the respective Departments. The construction multiplier calculation of 7.8 is explained in Appendix 4. Using the construction multiplier, and assuming the share of capital across Departments remains constant post 2025, it is calculated that on average approximately 80,742 construction jobs will be sustained per year based on the capital allocations agreed in the new NDP.

Table 5: Average number of construction jobs sustained per year from NDP

	Estimated Construction related share	Construction Multiplier – as calculated	Capital Allocations 2021 - 2025 (€million)	Average total constructions jobs sustained for 2021 – 2030[22]
Agriculture, Food and the Marine	0.5	7.8	1,413	12,073
Children, Equality, Disability, Inclusion and Youth	0.85	7.8	255	5,537
Defence	0.15	7.8	697	1,779
Education	0.88	7.8	4,372	71,427
Enterprise, Trade and Employment	-	7.8	2,708	5,365
Environment, Climate and Communications	0.9	7.8	4,179	74,139
Finance	0.1	7.8	107	188
Foreign Affairs	0.53	7.8	113	1,067
Further and Higher Education, Research, Innovation and Science	0.28	7.8	2,889	14,572
Health	0.87	7.8	5,657	91,934
Housing, Local Government and Heritage	0.95	7.8	17,564	302,806
Justice	0.8	7.8	1,352	18,501
Public Expenditure and Reform	N.A	7.8	1,462	-
Rural & Community Development	0.72	7.8	962	12,082

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[22] Since capital allocations were only agreed to 2025 in the NDP process, an annual 5% increase for every year between 2026 and 2030 is assumed to calculate the average total construction jobs sustained for 2021 to 2030.

Social Protection	0.22	7.8	81	308
Tourism, Culture, Arts, Gaeltacht, Sport and Media	0.77	7.8	1,004	13,487
Transport	0.72	7.8	13,001	159,849
Office of Public Works	0.91	7.8	1,413	22,309
Total number of construction jobs sustained for 10 years				**807,423**
Total numbers of construction jobs (direct and indirect) sustained annually				**80,742**

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