Impact Evaluation of the R&D Tax Incentive in South Africa

September 2019

Executive Summary[1]

- **Firms undertaking research and development (R&D) in South Africa can apply for a 150% tax deduction on their R&D expenditure.** The objectives of this incentive, as outlined by Mjwara (2017), are to promote innovation (new products, processes and services) and competitiveness that lead to employment, technology spillovers and economic growth. The economic rationale for the incentive is that encouraging firms to spend more on R&D helps to counteract the effect of several market failures that could undermine private incentives to invest in R&D. National Treasury (2019) estimates that the incentive cost just over R900 million in government revenue forgone during the 2013/2014 to 2016/2017 financial years.

- **This report presents the findings of an impact evaluation of the R&D tax incentive that aims to generate evidence about the value/benefits** as anticipated under Section 11D of the Income Tax Act. The evaluation was undertaken by World Bank (WB) experts working in a project led by the Department of Science and Innovation (DSI) and the National Treasury (NT) tax policy team. The purpose of the evaluation is to inform policy decisions about the incentive going forward, including any possible adjustments and/or its continuation beyond October 2022 (the end date of current window stipulated under Section 11D of the Income Tax Act). It also complements the recently released report by the Department of Planning, Monitoring and Evaluation (DPME) on the public incentives targeting businesses in South Africa.

- **The evaluation forms part of a WB analytic program that draws on newly available administrative data to examine firm-level trends in productivity and innovation in South Africa (World Bank 2017).** This evaluation used administrative data collected by the DSI since the incentive was introduced in its current form in 2012. This includes the information gathered in the applications for the incentive and data gathered by mandatory progress reports for those firms that have at least one project approved for the deduction.[2] Because the administrative data collected by the DSI only extends to firms accepted into the programme, the existing data was complemented with a survey emailed in September and October 2018 to all the firms that applied for the incentive between 2012 and 2017 (including firms whose applications were not approved).

[1] Dr. Gareth Robert (University of the Witwatersrand and World Bank) led the impact evaluation. The WB analytic program is led by Gabriel Goddard (Lead Economist, World Bank) and Wayde Flowerday (Private Sector Development Specialist, IFC). The team appreciates the support of the team at the DSI and NT, as well as reviewers and WB colleagues who commented on the survey instrument and earlier versions of the report.

[2] The data captured from the application forms (that is available to the study) includes the total revenue, annual R&D budget, and then a list of the names of the specific R&D projects, the economic sector of the project, the expected expenditure related to the project and the number of R&D staff anticipated to work on the specific project (by type, such as engineers or scientists etc). The progress report template included questions about the status of the R&D projects listed in the application, the firm's R&D expenditure incurred for the financial year (and what proportion of this expenditure went to different stages of R&D – basic, applied etc.) and a set of self-reported outcomes relating to R&D activity (for example, firms are asked if the incentive increased their competitiveness and if they would have continued R&D without the incentive).

- The **specific scope and objectives of the impact evaluation** were to:
    - *Produce "descriptive statistics"* to have an overview of the types of firms e.g., (industry, size, technology profiles) and types of R&D that have been approved. This should enable a high-level mapping of approved and rejected firms.
    - *Assess the effectiveness of the incentive*, i.e. whether additionality has been achieved – would successful firms have invested in the absence of the incentive; and whether unsuccessful firms are investing anyway (and to the same estimated extent or not).
    - To the extent possible given the data, *assess the economic impact* of the supported R&D in terms of firm-level innovation outputs, employment, productivity and other relevant outcomes expected of business sector R&D activities.
    - *Provide recommendations on policy implications*, and specifically options for strengthening the data /information captured in DSI and SARS forms so as to be better prepared for monitoring and evaluation in future years

Descriptive results emerging from the analysis of the application and progress report data:

- *Sectors and size of firms:* While there are no restrictions on the eligibility criteria of the firms that apply for the incentive other than that they have to be operating and carrying on R&D in South Africa, the analysis of the application data shows that a majority of applications (almost 80%) are for projects in manufacturing and business services (including financial intermediation) sectors, and that the proportion of applications that are approved or partially-approved is much lower for the business services sector. Half of all applications are from firms with a total revenue (in 2016 prices) of R50 million or more. Larger firms are more likely to have approved applications. It is not possible to assess the technology profile of the firms within sectors using the data captured from the applications.

- *Importance of the incentive for the private sector's R&D projects*: Among the 183 firms that have submitted progress reports (which is less than a third of the firms that were required to submit reports), almost all (173) indicated that they would have continued with R&D without the incentive. Surprisingly, as many as 45% (78) of these 173 firms confirmed that they would have continued with R&D at the same scale. In other words, these firms are telling us that the incentive had no effect on their R&D spending decisions. The results suggest that DSI may want to reconsider the targeting of the programme in the context of the underlying rationale of the incentive – which is that firms in South Africa under-invest in R&D when the total benefits spill over to other firms, workers and consumers (this is the economic logic of private-sector R&D incentives). However, as we explain in the report, the reader is advised against drawing conclusions about the efficacy of the incentive based only on the feedback of beneficiaries. To reiterate, less than a third of the firms with approved projects submitted progress reports, and as a result of these gaps it is not possible to estimate the cost of the intervention or to draw inferences regarding the self-reported efficacy of the incentive and firms' R&D activities. Further, it is not possible to estimate the counterfactual outcomes for the majority of beneficiaries – which is essential when it comes to making robust estimates about the impact of such a policy.

- *Economic benefits*: Despite the limits to the data, there is anecdotal evidence that the incentive may be assisting some firms. More than half of the firms that submitted progress reports believe that the incentive increased their competitiveness and market share. This, though, also highlights an important concern regarding interventions that are restricted to qualifying firms: some of the benefits from the incentive may come at the expense of other domestic firms that do not receive assistance. In the report, we outline how this issue has implications for any assessment of the total cost and benefits of the intervention. It is important to note once again that it is not possible, given the limited response rates and gaps in progress reporting, to provide a reliable estimate of the innovation outputs of the beneficiary firms. For example, zero of the 75 firms that submitted progress reports in 2017 listed any registered patents. It would not be advisable to draw inferences on the efficacy of the incentive based on such data – even if it were complete – because doing so does not consider what would have occurred in the absence of the incentive.

Impact evaluation approach and main results:

- *Evaluation methodology*: Since almost all (173/183) firms that have submitted progress reports indicated they would have continued R&D without the incentive, a simple assessment of the outputs and outcomes of the beneficiaries after would lead to biased estimates of the effect of the incentive – because estimating the impact in this way would only be valid if none of the firms continued R&D (this is the implicit assumption). In the report, we instead use the only scientifically valid approach to estimating the causal effect of this particular policy. This requires that we estimate what would have happened to the beneficiary firms if they had not received the incentive. For the purposes of this evaluation we assess the direct impact of the incentive by comparing the outcomes for a subset of the beneficiary firms (the treatment group) to firms with similar baseline characteristics that applied for the deduction but whose applications were unsuccessful (the control group). The administrative data collected the DSI only covers those firms that were accepted into the programme, which is why a survey was emailed in September and October 2018 to all firms that applied for the incentive between 2012 and 2017 (including firms whose applications were not approved).

- *Additionality of the incentive for R&D spending*: The estimates of the effects of the R&D tax incentive on the outputs and outcomes measured in the survey suggest that the incentive likely increases reported spending on R&D (additionality). On average, the firms in the control group sample (used to estimate the counterfactual outcomes of the beneficiaries) spent approximately R1.7 million on R&D while those in the treatment group report spending an additional R3.6 million (a total of R5.3 million) on average. Thus, for these beneficiaries the incentive appears to have more than doubled their reported R&D expenditure. However, these results pertain only to 18 treatment firms (out of the more than 600 firms that participated in the incentive during the timeframe used for the sample) and 14 control group firms (these are firms that applied for the incentive but were rejected). Thus, while it may be tempting to extrapolate this finding, to for example assume that it doubled all R&D expenditure in the economy, we would again advise caution. The firms' whose data we were ultimately able to use to assess the impact are not a random cross-section of the firms that participated in the incentive. In fact, these 18 firms are

smaller than average. Furthermore, we cannot determine if the firms that received that incentive have relabelled other expenses as R&D. What we can say at this point is that there is evidence to suggest that the incentive causes an increase in the reported level of R&D spending, but we cannot draw inferences on the likely additionality at an economy-wide level.

- *Additionality of the incentive for economic outcomes:* Due to the small size of the sample, the evaluation is unable to demonstrate a significant effect of the incentive on the productivity, size or profitability of the firms. The data limitations also mean that it is not possible to estimate the economic benefits of the incentive at an economy-wide level. To do so, we would need a reliable estimate of what would have happened to the beneficiary firms had they not received the incentive and what happens to firms that benefit from the incentive indirectly through any spillovers. To do this, we would also need data on the outcomes of interest for all firms that could possibly have been affected by spillovers. As is, it is not possible with the progress report data to present the R&D expenditure for most of the participating firms, which means that we cannot determine the cost of the program from the data that is available to this study. This may be possible to do with the tax data from SARS shares in future, but this data was not available to the study team.

Recommendations:

Based on the analysis of the administrative and survey data, as well as the qualitative feedback from firms, the report makes the following recommendations for further discussion by DSI, NT and stakeholders[3]:

1) *Streamlining the application process*: The continued effort by DSI to eliminate the backlog of applications that materialized when the pre-approval for incentive was introduced in 2012 has resulted in faster processing. Streamlining the application process would further reduce the administrative burden for firms, particularly for start-ups and MSMEs, and help to bring down the turnaround time for processing applications. For firms with long-term R&D programs, instead of submitting entirely new applications for new project, firms could apply for additional projects as part of a portfolio, as a way to streamline the administrative process. Presently, firms have to submit new applications every time they want to add new projects for the incentive. There is also, as we explain, now way to determine if firms have stopped claiming for particular projects, and if firms are claiming within the amount they have been allocated for the project.

2) *Deploying digital tools to make it easier for firms to apply and to monitor their progress on the projects*: Applications for the incentive as well as all progress reports should be submitted online using a single login for the firm as one of the steps to simplifying the process. The system should automatically inform the firm's representatives of the progress of the applications. This system should also automatically generate pre-defined reports for the purposes of M&E. Ideally, it could be

[3] A workshop will be organized with DTS and NT in October 2019 to discuss the findings and recommendations of the evaluation and obtain suggestions from stakeholders on areas for improvement and implications of the report.

developed together with other government departments (such as the Department of Trade and Industry) responsible for administering the business incentives outlined by the DPME (2018) to have a holistic picture about the impact of incentives.

3) *Introducing scoring tools into the application process focusing on additionality*: Complementing the eligibility criteria with scoring rules could strengthen the assessment of the applications to the incentive. Administrative information is easier to verify, whereas the novelty of R&D activities and other characteristics of the projects requires experts that understand the relevant R&D market and can assess the feasibility of obtaining the desired innovation outputs and outcomes. Most R&D fiscal incentives do not include a pre-approval process, but instruments like matching grants make similar assessments about the pertinence and novelty of R&D and it would be useful to review the good practices from relevant countries. The rules should be based, in part, on the domain and context-specific knowledge of the private and academic experts that are responsible for selecting projects. The rules can explicitly consider the extent to which a project is likely to lead to spillovers or the extent to which protecting any intellectual property is advisable for the particular project.

4) *Increasing compliance with progress reporting*: Different options should be considered to improve compliance of firms that received incentives, as a minority of firms submits progress reports. The DSI could require firms to submit progress reports for each project prior to rolling over the incentive when this was awarded for multi-year projects and/or accepting new applications for other projects. The online system could be configured to send reminders in this regard. Further, the progress report questions should, where possible, focus on gathering feedback at the level of the project (rather than the application or firm). The progress report template has recently been updated building on the lessons of this evaluation to better capture key variables of interest for policy, and the report makes several additional recommendations relating to these templates. The DSI should set out the limit of the amount of expenditure that a firm can claim for the financial year in the confirmation letter sent to firms (and that the firms then submit to SARS as part of their tax compliance).

5) *Coordination of the support programs for innovation*: DSI and the other departments coordinating incentives should work together to determine if there are possible synergies in the efforts to administer these programs.

6) *Using the tax data that SARS shares with Treasury for M&E of the R&D incentive*. It is also advisable that the Treasury use the data that is currently shared with Treasury by SARS to provide M&E support to the DSI. This data could be used to provide the DSI with a more comprehensive overview of the cost of the program as well as answers to many more, although not all, of the questions that this report set out to answer (but which it could not because of the gaps in the data). If the DSI were to work with Treasury to use this data, there would be no need to capture any information on the expenditure of the firms in the progress reports – the progress reports could instead focus solely on the innovation outputs as well as gathering feedback from firms that can be used to answer any other questions the stakeholders have.

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"Innovation has nothing to do with how many R&D dollars you have. When Apple came up with the Mac, IBM was spending at least 100 times more on R&D. It's not about money. It's about the people you have, how you're led, and how much you get it."

– Steve Jobs

Introduction

This report presents the results from an impact evaluation of the Research and Development (R&D) Tax Incentive in South Africa. It uses what is known as a quasi-experimental approach to estimate the effect of the incentive, drawing on newly available administrative data collected by the Department of Science and Innovation (DSI) combined with survey data obtained for the evaluation. The study was undertaken by a World Bank team in coordination with the DSI and the National Treasury. The evaluation also benefited from the inputs of stakeholders and international experts, and the findings will be presented to obtain suggestions for improvement and to unpack the recommendations.

In terms of Section 11D of the Income Tax Act (1962), all firms undertaking R&D in South Africa can apply for a 150% tax deduction on their R&D expenditure. According to the Department of Science and Technology (DSI), the primary objectives of this incentive are to promote R&D led innovation (new products, processes and services) and competitiveness that lead to employment, technology spillovers and economic growth (Mjwara, 2017). This study estimates the direct effect of the incentive on, among other outcomes, R&D spending and firm profit in 2017. The results, which extend to a subset of firms that received the incentive between 2013 and 2016, suggest that the incentive leads to additionality in the form of increased spending on R&D. However, due to data constraints, it is not possible to identify any effects on innovation and firm-growth.

The R&D tax incentive deduction was introduced on 1 November 2006. From this date until September 2012, companies had to submit retrospective R&D tax incentive claims directly to the South African Revenue Service (SARS) and only report to the DSI about their R&D expenditure; from 1 October 2012, the pre-approval system was introduced, wherein companies submit applications to the DSI for approval of R&D activities by the Minister of Science and Technology before claiming for a tax deduction from SARS. While the beneficiaries are required to submit annual progress reports, less than a third of firms that receive the incentive submitted progress reports. It is therefore not possible to estimate the cost of the intervention or to draw inferences regarding the self-reported efficacy of the incentive and firms' R&D activities for the majority of firms that are part of the programme.

As we explain in this report, we advise the reader against drawing conclusions about the efficacy of the incentive based on the feedback of the beneficiaries. Nevertheless, among the 183 firms that have submitted progress reports (which is than a third of firms that were required to submit reports), almost all (173) indicated that they would have continued with R&D without the incentive. Surprisingly, as many as 45% (78) of these 173 firms confirmed that they would have continued with R&D at the same scale. In other words, these firms are telling us that the incentive had no effect on their R&D spending decisions. Taken together, the results suggest that DSI may want to reconsider the targeting of the programme in the context of the underlying rationale of the incentive – which is that firms in South Africa under-invest in R&D when the total benefits spill over to other firms, workers and consumers. To reiterate, less than a third of the firms with approved projects submitted progress reports, and as a result of these gaps it is not possible to estimate the cost of the intervention or to draw inferences regarding the

self-reported efficacy of the incentive and firms' R&D activities for the majority of the firms that form part of the programme. Further, it is not possible to estimate the counterfactual outcomes for the vast majority of the beneficiaries – which is essential when it comes to validly measuring the impact of such a policy.

There is some anecdotal evidence that the incentive may be assisting firms. More than half of the firms that submitted progress reports believe that the incentive increased their competitiveness and market share. This, however, in turn highlights an important issue regarding interventions that are restricted to qualifying firms: some of the benefits from the incentive may come at the expense of domestic firms that do not receive assistance. In the report we outline how this issue also has implications for any assessment of the total cost and benefits of the intervention.

Since almost all of the firms reported that they would have continued R&D without the incentive, a simple assessment of the outputs and outcomes of the beneficiaries would lead to biased estimates of the effect of the incentive. In this report our estimates of the counterfactual outcomes of beneficiary-firms are calculated by matching (the baseline characteristics of) a subset of beneficiary firms to firms that applied for the deduction but whose applications were not successful. These results are, as mentioned, limited to a small subset of all the beneficiary firms that responded to the survey (18 treatment and 14 control). The impact of the incentive could be more pronounced among firms that did not respond to the survey. Further, the results do not consider knowledge and other spillovers, including the extent to which the intervention had an effect on market concentration.

Becker (2015: 3) points out the motivation for R&D incentives "*proceeds from the observation that industrial R&D exhibits a classic public goods problem in that it is both non-rivalrous and not (completely) excludable. If the private rate of return thus is below the social rate of return, as firms are unable to fully appropriate the returns from their R&D, private R&D investment has positive externalities and could be lower than socially optimal.*" This is the economic logic for instituting the incentive, and should be explicitly considered when assessing the eligibility of applications for the incentive.

Busom et al. (2014) note, though, that R&D incentives have certain drawbacks. First, for those incentives awarded at the discretion of public agencies, there are substantial information requirements. Second, in the case of tax incentives "the specific design is important, as they might be easily claimed for projects that yield high private returns and would have been carried out anyway." Montmartin & Herrra (2015: 1066) also point out several other disadvantages to using indirect (where firms are required to make an initial investment) incentives. It is often difficult to contain the cost of the incentive, and "[t]he effects are limited for firms who do make sufficient profit or which invest heavily in R&D (large companies) because they do not reap the maximum benefit from the financial measures." Further, "[f]inancial incentives favor R&D projects with the highest short-term returns" and "projects with high social returns to R&D will not be favored by this type of measure."

Chen et al. (2018: 1) believes there are two important questions that are central to policy-makers when assessing the efficacy of R&D incentives:

1) *Is R&D investment responsive to fiscal incentives and, if so, do firms engage in evasion or manipulation of reported R&D in response to the tax incentives?*
2) *What is the effect of fiscal incentives on productivity growth, and how much do firms value R&D investment in terms of future profits?*

Hall & Van Reenen (2000) and later Becker (2015) survey the empirical evidence on public R&D policies. While earlier studies suggest that public incentives may crowd-out private spending, the evidence that has emerged over the past two decades suggests tax incentives can promote private investment in R&D and that this has positive effects on innovation and productivity. It is important to note, however, some of these results rely on tenuous assumptions about the amount of R&D spending and firm-level outcomes in the absence of these incentives. As Indeed, Chen et al. (2018: 1) note, "[a]nswers to these questions are often confounded by the lack of large and plausibly exogenous variation in tax incentives."

Despite these limitations, a more rigorous set of studies that explicitly estimate the counterfactual outcomes of firms have demonstrated the positive effects of indirect incentives. These studies measure the impact of incentives by also estimating what happened to firms with similar baselines characteristics that did not receive the assistance. For example, Dechezleprêtre et al. (2016) show that (in the United Kingdom) a tax incentive for R&D led to an increase in the number of patents and that "aggregate business R&D would be around 10% lower in the absence of the tax relief scheme". In addition, the R&D induced by the tax policy creates positive spillovers on the innovations of technologically related firms. Chen et al. (2018), using tax administrative data, find large firm-level productivity responses that are due to a R&D tax incentive in China (Chen et al. use variation in the intensity of the allocation of the incentive to estimate these effects). They note though that this occurred even while almost a third of the increase in R&D expenditure attributed to the incentive is due to the relabeling of administrative expenses.

The evidence on the impacts of R&D incentives is, however, not always necessarily positive in the sense that they do not always lead to increased R&D for all beneficiaries or to improvements in all of forms of innovation. For example, Bronzini and Iachini (2011) find that in Italy "small enterprises increased their investments—by approximately the amount of the subsidy they received—whereas larger firms did not." Czarnitzki et al. (2011) also show that in Canada "recipients of tax credits show significantly better scores on most but not all IP performance indicators." This is one of the reasons why Antonelli & Crespi (2013) argue "while the decision to rely on discretionary incentives based on beauty contest/competitive selection procedures may imply relevant costs, their benefits can be increased by pursuing a 'picking the winner strategy'." Busom et al. (2014) also highlight the importance of understanding the market failure that leads to under-investment in R&D by firms. Is the primary constraint to R&D access to finance, or the cost of protecting intellectual property? Indirect (tax) incentives are more likely to stimulate R&D in the case of the latter.

Thus, while R&D incentives may stimulate economic growth, it should not be taken for granted that they will lead to the anticipated outcomes. The success of such incentives will, as with most policies intended to promote firm growth, depend on a number of factors including the peculiar constraints of the firms in any given economy. The evidence outlined earlier comes from economic contexts that are likely to differ in important ways from South Africa. China, for example, has a much larger population and therefore market for new products and services. Similarly, Canada and Italy have wealthier populations. All three have more educated workforces with a higher proportion of STEM graduates. This provides the motivation for the impact evaluation of the R&D tax incentive in South Africa. The first part of this report outlines a high-level results chain for the R&D Tax Incentive, which should only serve as the foundation for a more intensive engagement on the Theory of Change (ToC) between all

the stakeholders to this programme. It may be possible to do so in collaboration with, and with the support of, the Department of Performance Monitoring and Evaluation (DPME).

Estimating the impact of the incentive on innovation, economic growth and employment requires data on these outcomes. Crucially, these outcomes should be measured for a set of firms that are similar to the beneficiaries – but who did not benefit from the incentive (including indirectly through knowledge spillovers). The report outlines and presents the administrative data gathered by the DSI, which oversees the implementation of the programme. This includes data that comes from the applications as well as the data gathered from the beneficiaries that have submitted annual progress reports.

The South African Revenue Service (SARS) has shared data with the Treasury pertaining to the claims made by the beneficiary firms, as well as other performance data for these and other firms in South Africa. This data can be used to determine a representative robust assessment of the impact of the incentive. However, it was not available to the team when starting this evaluation, and it is also limited to the extent that it only captures information on outcomes that form part of the tax compliance of these firms. This is why a questionnaire was designed and then emailed to all firms that applied for the incentive between 2012 and 2017. The report presents the feedback that was gathered from this survey, and the results from impact evaluation. These include, as mentioned, that the incentive may increase spending on R&D and the remuneration of R&D staff. It is not possible to show that the incentive is having the desired effect on economic growth, employment and knowledge. It is also not possible to determine the total cost and benefits of the incentive in the presence of spillovers. Therefore, the report makes the following recommendations:

1) Given the substantial cost of the incentive, applications for the incentive as well as all progress reports should be submitted online using a single login for the firm. This system should automatically generate pre-defined reports for the purposes of monitoring and evaluation (M&E), and it could even be developed together with other government departments (such as the Department of Trade and Industry) responsible for administering the business incentives outlined by the DPME (2018). The report makes several additional recommendations relating to the application and progress report form templates. Furthermore, firms should reapply for the incentive every year (or at least be required to submit progress reports for each project in order to roll over the incentive). Each project should be assigned a project reference number. Further, instead of submitting entirely new applications, firms should be able to apply for additional projects as part of a portfolio. The progress report questions should, where possible, focus on the gathering feedback at the level of the project (rather than the application or firm), and it should focus on collecting data that cannot be gathered from other sources (such as the tax data that SARS shares with the National Treasury). The system should also automatically inform the firm's representatives of the progress of the applications. SARS should be able to audit any claims against the information that is provided in the applications as well as the progress reports.
2) Introduce transparent scoring rules to assess the applications for the incentive. The rules should be based, in part, on the domain and context-specific knowledge of the experts that are currently responsible for selecting projects. It may then be possible to automate parts of the application

process. These rules should explicitly consider the extent to which a project is likely to lead to spillovers or the extent to which the cost of protecting any intellectual property is prohibitive for the particular project. The application form should be amended to incorporate questions that enable these experts to do so. International best practice suggests that these experts and other stakeholders work together on interrogating the nuances of any theory of change (ToC) – as well as the unintended consequences – for firms operating in a particular domain pursuing particular forms of R&D, extending on the ToC for incentives outlined by the DPME (2018).

3) The DSI, Treasury and SARS should work more closely together to develop a unified information system for the incentive. In the interim, it is advisable that the Treasury use the data that is currently shared with Treasury by SARS to provide M&E support to the DSI. This data could be used to provide the DSI with a more comprehensive overview of the cost of the program as well as answers to many of the questions that this report set out to answer (but which it could not because of the gaps in the data). Indeed, the data that SARS shares with Treasury could even be used to implement a more representative and rigorous evaluation of the impact of the R&D incentive on all of the outcomes that are currently being measured in the tax data that SARS shares with Treasury (such as the impact of the incentive on profit and employment)..

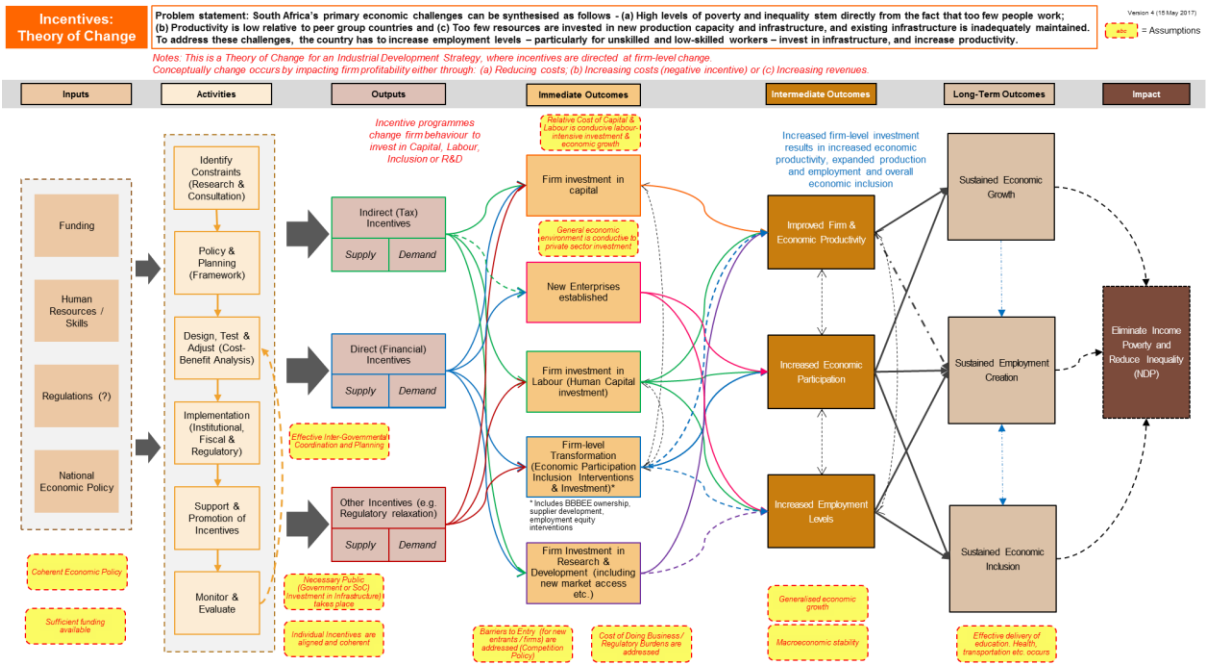
Results chain

Table 1 presents a high-level results chain for the incentive. It includes the main inputs that form part of R&D, and the activities associated with using these inputs to develop at least one new or improved product, service or process. These new products or services open new markets thus generating firm-level growth and employment. Similarly, new or improved processes and knowledge increase productivity for the firm as well as other domestic firms that learn. Figure 1 presents the overall theory of change for business incentives in South Africa taken from the DPME (2018) report, which includes indirect (tax) incentives. International best practice suggests that these experts and other stakeholders work together on interrogating the nuances of any theory of change (ToC) – as well as the unintended consequences – for firms operating in a particular domain pursuing particular forms of R&D, extending on the ToC for business incentives outlined by the DPME (2018). The latter is included to provide the reader with a sense of where the R&D incentive fits into the national plan, and also to serve as the starting point for a more detailed ToC for this particular incentive. The development of a ToC would normally form part of the management of the incentive by the stakeholders that are responsible for implementation and monitoring, as part of standard planning processes.

Table 1: High-level results chain for the R&D Tax Incentive

Inputs	Activities	Outputs	Outcomes
Human capital	Research & Development	New or improved product, service or process	Economic (firm) growth
Infrastructure	Registration of Intellectual Property	Knowledge	Employment
Financial resources			Knowledge spillovers

Figure 1: Incentives Theory of Change (DPME, 2018)



R&D Tax Incentive data

The following sections present summaries of both the administrative data gathered by the DSI as part of the programme as well as the data gathered from the online survey emailed to all firms in 2018 that applied for the incentive between 2012 and 2017. This administrative data includes the data gathered as part of the application process as well as data collected in annual progress reports submitted by firms that have claimed the incentive. 1: Review of good practices in the design and roll out of R&D tax incentives

Advanced economies have a long history of using tax incentives to stimulate R&D, but the design and implementation has substantial heterogeneity. R&D tax incentive schemes are widely adopted in advanced economies, including innovation leaders like the United States and Japan. Within the European Union, only Germany and Estonia currently do not have a tax policy aimed directly at stimulating innovation. Many emerging countries have also deployed similar instruments, with varying degree of success based on recent evaluations. The European Commission (2014) reviewed R&D incentives in 33 mostly advanced economies and found substantial heterogeneity across the countries with most countries offering more than one type of instrument. The study recommends best practices around three key areas of scope, targeting and organization practice (see Table below, reproduced from this review):

- **Scope** relates to the expenditure items that are covered and how the incentive is paid out. The EC study recommends that incentives use the total R&D in the tax year as basis for incentive rather than the increase between a base year and the relevant tax period to reduce administration costs and avoid triggering firms to game the system around the timing of their incentives. In order for knowledge to be transferrable between firms, it is recommended that the incentive be paid in relation to the wages of researchers and be targeted at projects that can contribute to the universal stock of knowledge rather than supporting projects that are restricted to the advancement of a firm's own state of expertise.
- With regards to **targeting**, best practice recommends that incentives be targeted towards young firms in all sectors regardless of size. This is in contrast to previous arguments that prompted many countries to target small firms. As the Organization for Economic Co-operation and Development (OECD, 2002) argues, larger firms which are responsible for the lion's share of research tend to benefit a larger proportion of R&D incentives. Targeting small firms is also based on the argument that while they are unlikely to have a significant impact on aggregate investment spending, they may contribute to innovative expenditures at the margin. However, it is younger firms (and not smaller firms per se) that drive innovation, and thus targeting shall be based on age and not size according to the EC study. Further, it is recommended that it be possible for incentives to have a carry-over facility and an option to receive a cash refund even when the innovation does not lead to profitability. This would provide firms with flexibility and certainty for investment decisions, and in particular support younger firms since they often take time to be profitable (European Commission, 2014). One risk with this approach is that established firms could split or reincorporate to gain access to the incentive.
- For easy **administrative processes** and measuring effectiveness, it is recommended that tax incentives have a one-stop online application process and systematic evaluations. The EC review recommends that feedback on qualifying expenses be provided within a year, and that countries consider immediate

refunds to smaller companies in order to assist with liquidity constraints. Countries using a pre-approval selection method in particular need to ensure that their feedback is punctual so as to not delay projects. Monitoring and evaluation require that robust firm-level data that can allow for robust qualitative analysis.

Figure 14: Summary of principles of good practice (for OECD countries)

Category	Practice	Best practice	Not recommended
Scope	Input related vs. output related R&D tax incentive	Input related	Output related
	Tax credits vs. enhanced allowances	Tax credits	
	Volume-based vs. incremental	Volume-based	Incremental
	Novelty requirement	New to the country (world)	Explicit incentive for imitation
	Expenditure covered	R&D wages	IP costs
Targeting	Region	Common rate for the country	Very specific design elements in different regions
	Legal form	Common rate for all legal entities	Exclusion of firms with foreign owner
	Firm size	No targeting	Targeting at large firms
	Brackets and ceilings	No brackets	Lower rate for small amounts
	Firm age	Young firms	Incumbents
	Field of activity/type of technology	No targeting	Targeting
	Minimum	No minimum	High threshold
	Negative tax	Yes, for young firms	No negative tax
	Carry-over provisions	Yes, for young firms	No carry-over provision
	Collaboration[a]	With public research institutes	Upstream R&D cooperation between large competitors
	Generosity[b]	Ambiguous	Over-subsidizing
Organization	Decision time/refund	Minimum possible	Longer than 1 year
	Electronic application	Yes	No
	One-stop application	Yes	No
	Public consultation	Yes	No
	Evaluation	Yes, planned	No
	Synergy[a]	Complimentary	Overlapping
	Stability[a]	Fixed design and rates for at least 5 years	Large and unexpected changes in the budget

Source: European Commission (2014)

In developing countries, there are usually weaker fundamentals for innovation and limited fiscal space for the incentives, but there are also more pressing needs for innovation that can be driving competitiveness. Weaker fundamentals include for example, lack of research institutions, shortage of skilled personnel, and a weak manufacturing base. This may make it more difficult and costlier for firms to undertake R&D. This means that firms may require more generous incentives. On the other hand, limited fiscal space and the opportunity cost of using these foregone taxes on other social needs make it imperative for government incentives to result in desirable returns.

Many of the good practice principles in advanced economies apply for developing countries but these governments may consider additional principles. Starting with coverage, developing countries could consider allowing incentives for innovation that is "new to the country" but not primarily "new to the world" and cross-country projects that emphasize collaborations (taking care that there is sufficient spending in-country). An incentive available in China allows up to 40% of the qualifying R&D expenses to be incurred outside China and a VAT exemption is available to foreign firms for providing R&D, offshore outsourcing services, or transferring technologies. In the Philippines, non-resident firms also qualify for the full R&D incentive (although it is conditional on not owning land in the Philippines) (Deloitte, 2018). Further, R&D incentives could encourage collaboration with research institutions including foreign institutions that are closer to the technological frontier.

R&D incentives linked to the salaries of researchers are recommended in advanced economies and in developing countries; they may assist domestic firms to hire foreign skilled personnel that would otherwise be too expensive. Such an incentive exists in Brazil, where firms can claim a super deduction of 160 percent of the total R&D expenditure based on the number of personnel who work on a research project exclusively (Deloitte, 2018). In India, firms can claim a super deduction on R&D expenses incurred on payments made to institutions of higher learning and research (ibid). The incentives are available to firms who claim in a year during which they made profit. Such an arrangement may foster greater transferability and spill-over of knowledge.

Governments in developing countries have made headway in introducing M&E systems that can measure effectiveness. In Mexico, qualifying firms are required to submit an annual report outlining the impact and benefits resulting from the approved R&D projects. The report must disclose the expenses incurred and investments made in connection with the authorized technological R&D project and be certified by a registered Chartered Professional Accountant (Deloitte, 2018). Firms are also required to and maintain a computer system that tracks the expenses and investment items that have been authorized and for the system to be made available on a permanent basis to government (ibid). Further, Mexican firms must also accept routine technical visits from authorities. In China, the tax authorities are required to intensify their administration of super deduction claims through regular inspections and monitoring, with audits for no less than 20% of all cases annually (Deloitte, 2018).

Several developing countries lessen the burden of the incentive by allowing for claims for failed projects to be made retroactively. Chinese firms undertaking R&D projects that span multiple years do not need to have renew the approval annually and a company may also apply for the super deduction retroactively, within three years after the expenses are incurred (Deloitte, 2018). The expenditure is deductible from gross income in the year paid or incurred and they be deferred and distributed over 5 years (ibid). The latter is conditional on fulfilling requirements such as the expenditure not being treated as an expense and being chargeable to capital account but not chargeable to property that is subject to depreciation or depletion.

Similar to advanced economies, developing countries tend to target small firms when they should be targeting young firms. For instance, Chinese SMMEs are eligible for a 175 percent super-deduction on R&D expenditure while the standard super deduction rate is 150 percent (Deloitte, 2018). And while the Mexican tax incentive has universal coverage, Mexico also offers R&D cash grants exclusively targeted at SMMEs. The potential effectiveness in South Africa is unclear because studies such as Kreuser and Newman (2018) show that large firms are currently the main drivers of innovation and productivity gains.

Appendix 2. Survey instrument

in the Appendix to the report presents the questionnaire used in the survey.

Currently, the application and progress report data are emailed, dropped off or posted (by mail) to the DSI. The DSI team responsible for overseeing the programme manually captures this data in Excel spreadsheets. These different sets of data are related to each other through the firm's application reference number. While merging the data it became evident that firms sometimes made mistakes when noting down this number on the forms. Some firms also tried to submit a single progress report for multiple applications.

One way to assist in the M&E of the programme would be to migrate the application and progress reporting completely online to the DSI's website for the incentive. The firm's representative (which may be a consultant) responsible for the application and reporting related to the tax incentive would register a single profile for the firm, along with the contact details of the firm's management, administrative staff and other staff that are responsible for R&D activities. Both the application and progress report forms should have built in checks to ensure that the consistency of the data that is gathered in these forms. This system will allow these representatives to track the status of their applications, and it will send the firm's representatives reminders for when the progress reports are due – along with any supporting documentation the firm should submit to SARS.

In the remainder of this report we will sometimes refer to firms that are "potentially eligible for the incentive" because we cannot determine, from that data that we have, whether the firms are still claiming the incentive (more importantly, we don't know the amount they are claiming – which is why it is essential that, at the very least, the DSI work with Treasury using the data SARS shares with Treasury to draw reports on the cost of the incentive). We believe firms should therefore have to reapply for the incentive every year – even just by indicating that they intend to claim for the upcoming financial year. This would incentivise compliance in reporting, as well as offer the aforementioned benefit for the M&E of the incentive of being able to keep track of which firms are participating in the incentive (we note that, in the progress reports, firms are asked what the status of the project is. Not surprisingly, for the minority of firms that submit progress reports, most are "on-going". This may be because there is no financial incentive for firms to stop the project). Firms should also be able to apply for additional projects rather than having to create additional applications (each project should instead have a project reference number). Firms that do not comply with the annual reporting should not be eligible for the incentive. It should be noted that the value of the incentive to firms is substantial relative to the likely cost of reporting – even if some firms believe the process is onerous.

These measures would allow the DSI and other stakeholders to gain a better sense the progress of the projects and the expenditure associated with these. If all the data relating to the incentive is gathered through an online system, it would be possible to draw automated reports for any M&E reporting by the DSI. This will also avoid the problems related to merging the data when the data is used for additional analysis. Further, the application forms could include more detailed information about the employment of workers in the firm, other expenditure (not just related to R&D), and potentially even questions relating to the perceived constraints to R&D and innovation in the South African economy – such as those that were included in the survey that was designed by the stakeholders

in the DSI and NT for the purposes of the impact evaluation presented in this report. This would provide the stakeholders with a better sense of the types of, and constraints of the, firms that have applied for the incentive.

Applications

All firms that apply for the incentive have to fill out an application form and send this to the DSI by post, email or by delivering it to the DSI offices. The DSI then allocates the application to internal assessors to determine the eligibility of the application (based on the sector of the firm), after which it is sent to an internal committee for adjudication. The application form records firm and the proposed project-level data.

Each application may have one or more projects. The data for these projects includes when the project will start and end (although there are a number of missing entries for these fields), as well as the number of scientists, engineers, technologists, technicians and managers that will be working on the project. Since these numbers relate to a project, it is not possible to determine precisely how many R&D staff there are in total because it is possible that some staff will overlap projects while others may focus exclusively on one. The questions should instead be stated in full-time equivalent (FTE) terms. The application form could be amended to include questions relating to the total number (hours) of R&D staff, including how many are anticipated new positions that will be created if the application is approved. It would also be useful to gather information on amount of the planned expenditure that will go towards different types of R&D (basic, applied etc.[4]) and towards different inputs (labour remuneration or capital expenditure etc.), as well as any other higher order objectives (such as the number of staff that are anticipated to participate in the production of any products, or if these are intended for new markets abroad etc.).

The DSI is advised to introduce transparent scoring rules to assess the applications for the incentive. The rules should be based, in part, on the domain and context-specific knowledge of the experts that are currently responsible for selecting projects. These rules should explicitly consider the extent to which a project is likely to lead to spillovers or the extent to which the cost of protecting this intellectual property is prohibitive for the particular project. The application form should be amended to incorporate questions that enable these experts to do so. International best practice suggests that these experts and other stakeholders work together on interrogating the nuances of any theory of change (ToC) for firms operating in a particular domain pursuing particular forms of R&D, extending on the ToC for incentives outlined by the DPME (2018). Ideally, this would also consider input from the firms that are affected.

In addition to these data, the application form data that is available to this report includes the total revenue of the firm and the firm's annual R&D budget. The firms that apply are asked the amount of expenditure planned for each project, but there are gaps in this data and the DSI uses the annual R&D budget instead to assess the expected cost of the incentive. Another concern is that there may be some measurement error. For example, a firm may enter 1 000,000 for one million (which may be interpreted as one thousand). It should be noted that once a project has been approved for the incentive there is no specified end date for eligibility. One way to manage the cost of the incentive is to have firms reapply, or only allow them to claim if they have submitted a progress report. Ideally,

[4] With clearly defined definitions for each form.

this would be managed through the online system that has built in checks to ensure the consistency of the data, among other beneficial features[5]. Since there is not end date, and it is not possible to verify when firms stop claiming for a project (or how much they are claiming), the number of firms that are potentially eligible for the incentive in a year is the cumulative sum of all the firms that were eligible for the incentive for the year. The same logic applies to the potential cost of the incentive.

The following figures present an overview of the applications received by the status of at application. In addition, Table 8 to Table 9 in the Appendix to the report disaggregate these summaries by the primary sector of the application and the total revenue categories of the firm. Partially approved applications are those applications for the incentive where some of the projects were approved and some of the projects were not approved. The DSI does not specify the amount of the claim a firm can make in the letter sent to firms notifying them about the status of the applications (which are submitted to SARS support the tax deduction) though.

The year of the application extends from 1 March of that year to end of February the following year. The DSI received 1097 applications between 2012 and 2017 from 726 firms. Of these, 46% were approved, 13% partially approved and 41% of the applications were rejected. These numbers may differ from previous reports because they do not include duplicate entries for the same projects that were submitted more than once, when there were a few minor inconsistencies regarding the status of some projects or as, in some cases, multiple applications from the firm were allocated a single reference number. For example, eight firms submitted progress reports for an application even though the information captured regarding the applications suggested that none of the projects associated with the application were approved.

45% of firms applying for the first time had their applications rejected. Firms that listed larger total revenue and R&D budgets, as well as those that intended to employ more Scientists, Engineers, and Technicians, were more likely to have projects accepted. 72% of the 726 firms only submitted a single application and only 10% submitted more than two applications. The number of applications has however decreased steadily over this period, perhaps because firms are not required to re-apply every year and the incentive is rolled-over indefinitely. In contrast, the percentage of applications with approved projects has increased over this period.

Different projects within a single application may span multiple sectors of the economy. The primary sector of the firm is the mode (most common occurring) of these sectors among all the projects listed in the application. Almost half of all applications are for firms with most of their projects in the manufacturing sector. Firms with most of the projects in the agriculture sector were the most likely to be approved or partially approved, whereas firms with most projects in the business services (which includes financial intermediation and real estate) sector were the least likely to have their applications approved.

Figure 4 shows that those firms that had at least one project accepted have larger R&D budgets than those that whose applications were not approved, even though - as is shown Figure 5 – there are no pronounced differences in the median number of R&D staff. However, since there is no data on the assessment, it is not possible to determine the underlying reasons for these patterns in the summaries of the application data. The patterns may be

[5] It may be useful to amend the process so that firms that have already had projects approved are able to submit applications for additional projects rather than submit entirely new applications. Each project should be assigned a project reference number so that it is possible to relate the progress report data to the project application (presently the project is identified by the name of the project which makes it difficult to merge).

related to the characteristics of the projects, the firms, the sector, the presentation of the application (including spelling mistakes or the number of specific R&D staff proposed), who filled out the application, or the domain expert responsible for initially assessing the eligibility of the application – among many other potential reasons. We should therefore be cautious about drawing inferences from the summaries presented in this section.

Figure 2: Total number of applications and proportion approved, partially approved or not approved for each financial year

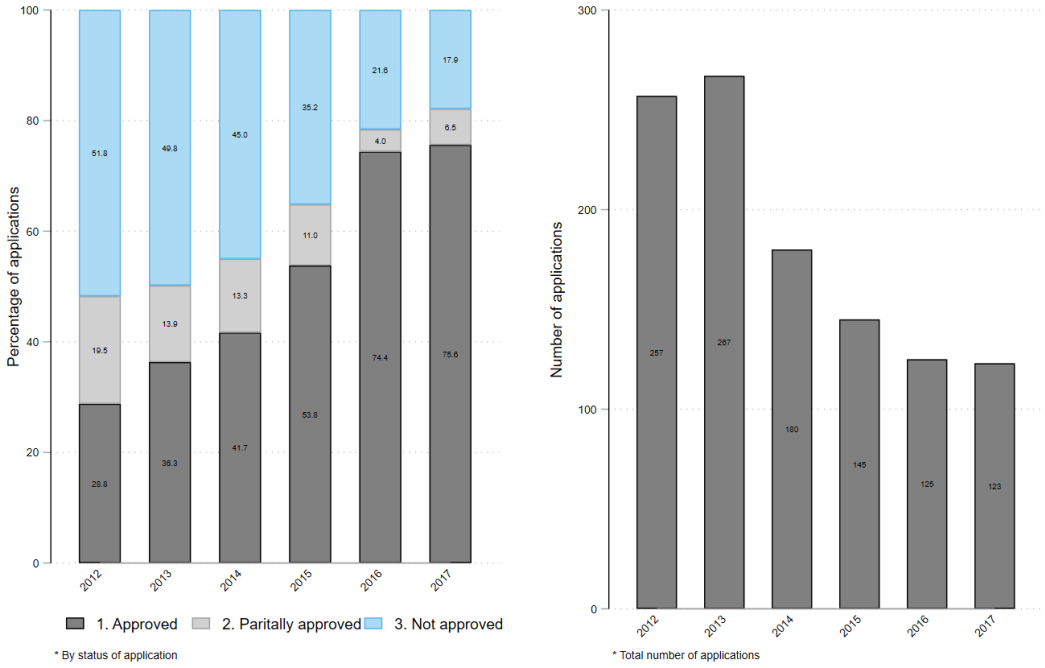
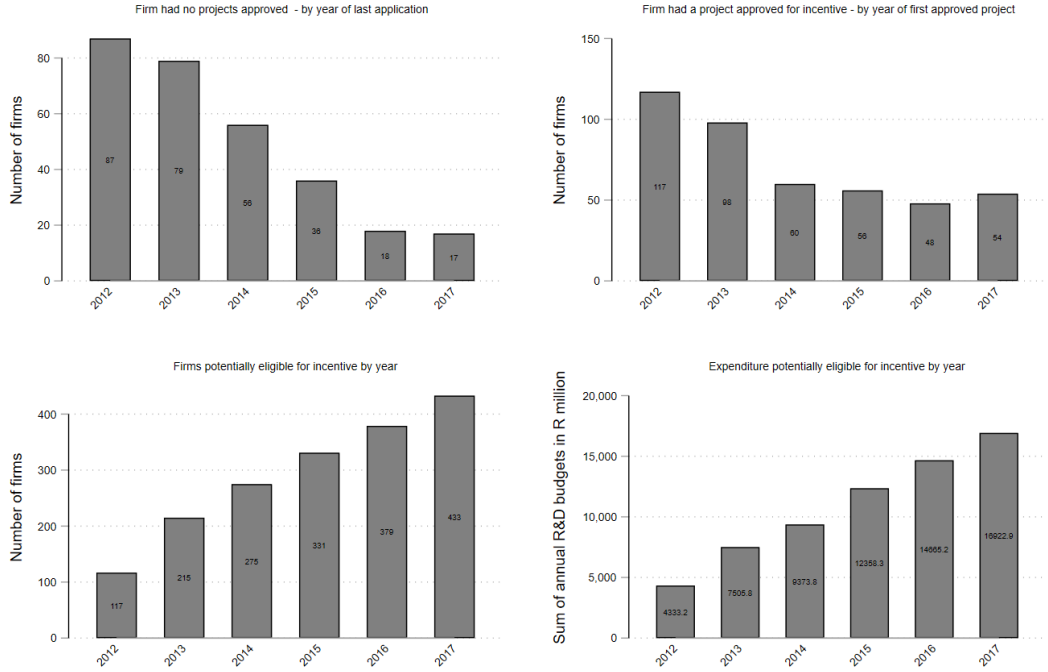


Figure 3: Overview of the number of firms that had at least one project approved for each financial year



Note that we use the term "potentially eligible" because we cannot, as explained, determine if these firms are still claiming the incentive in this year (there is, as mentioned, no way for us to determine which applications have been completed).

Figure 4: Median R&D budgets for firms by status of application for each financial year

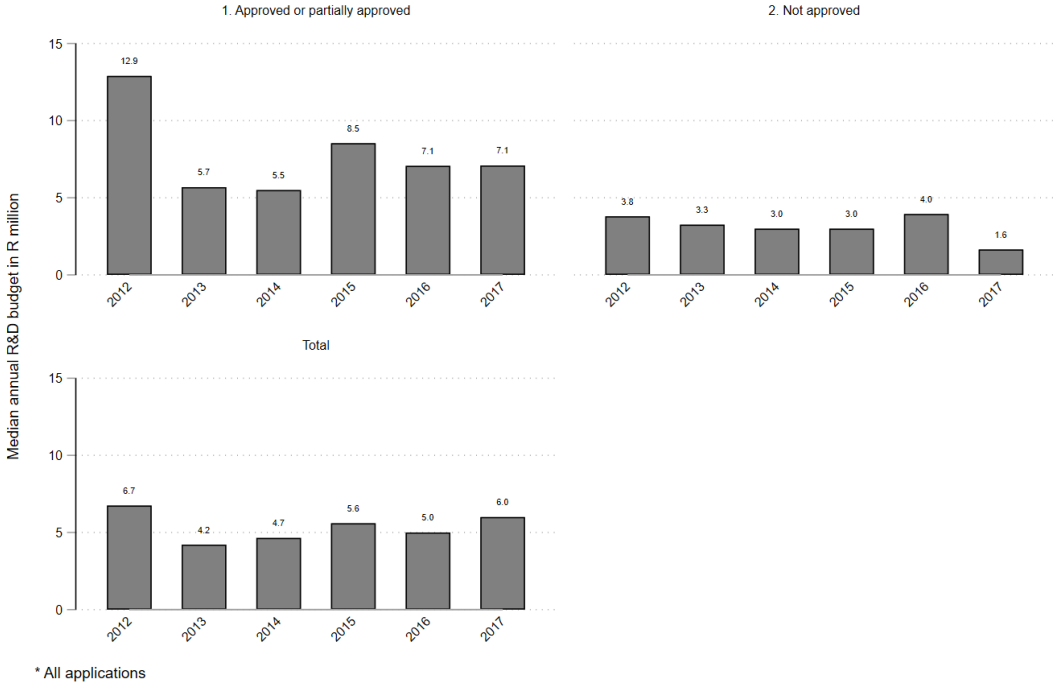


Figure 5: Median number of planned R&D staff by status of application for each financial year

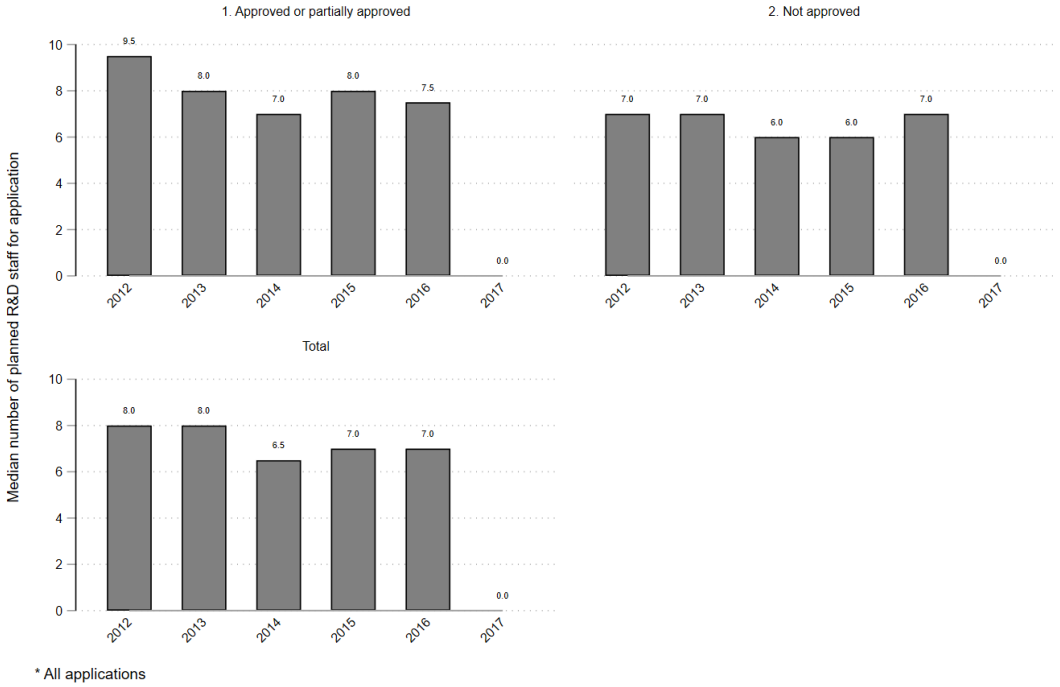


Table 2: Summary of applications by status of application for each financial year

Number of applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	124	134	99	94	98	101	650
2. Not approved	133	133	81	51	27	22	447
Total	257	267	180	145	125	123	1097

Percentage of applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	48	50	55	65	78	82	59
2. Not approved	52	50	45	35	22	18	41
Total	100	100	100	100	100	100	100

Median of the firms' annual R&D budget for all applications in R million by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	12.9	5.7	5.5	8.5	7.1	7.1	7.3
2. Not approved	3.8	3.3	3.0	3.0	4.0	1.6	3.3
Total	6.7	4.2	4.7	5.6	5.0	6.0	5.4

Median number of R&D staff for all applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	9.5	8.0	7.0	8.0	7.5	0.0	7.0
2. Not approved	7.0	7.0	6.0	6.0	7.0	0.0	7.0
Total	8.0	8.0	6.5	7.0	7.0	0.0	7.0

Average number of R&D staff for all applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	23.7	16.0	12.5	19.9	20.3	5.8	16.6
2. Not approved	16.1	14.5	10.5	7.9	13.6	3.9	12.9
Total	19.8	15.3	11.6	15.6	18.8	5.5	15.1

Average number of Scientists for all applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	2.3	2.2	1.5	1.4	2.2	0.7	1.8
2. Not approved	0.5	0.6	0.8	0.6	1.1	0.3	0.6
Total	1.4	1.4	1.2	1.1	2.0	0.6	1.3

Average number of Engineers for all applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	5.3	3.6	2.3	5.4	3.1	0.7	3.5
2. Not approved	2.3	3.1	2.4	2.2	1.9	1.9	2.5
Total	3.8	3.4	2.3	4.2	2.8	0.9	3.1

Average number of Technologists for all applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	3.3	1.2	1.6	2.1	2.3	0.4	1.8
2. Not approved	4.1	2.6	2.3	1.0	1.9	0.2	2.7
Total	3.7	1.9	1.9	1.7	2.2	0.4	2.2

Average number of Technicians for all applications by year of application

Status of application	2012	2013	2014	2015	2016	2017	Total
1. Approved or partially approved	4.1	2.5	1.8	4.7	4.1	1.6	3.1
2. Not approved	1.8	4.4	1.3	1.1	3.2	0.2	2.4
Total	2.9	3.4	1.6	3.5	3.9	1.3	2.8

Progress reporting

All firms that have had applications approved or partially approved are required to submit progress reports for the application. The first part of the progress report captures R&D expenditure as well as the status of the projects listed in the application. The second part of the report gathers data on the self-reported outputs (or outcomes) of the firm in relation to their R&D. It appears that some firms with multiple approved or partially approved applications have submitted only one progress report for all of these. However, the way the questions are structured in the progress report template requires the firm to answer to the application-level outcomes. It is also very difficult to relate the project-level data in these reports to the original applications – because the name of the project is used as the identifier and this is often spelt differently between these data sources. Each project should instead be given a project reference number.

While reporting on the progress of all approved applications is mandatory, the proportion of firms that have submitted reports is low. **Error! Reference source not found.** presents the lower bound of the percentage of potentially eligible applications with reports for each year from 2013 to 2018. Recall that we use the term "potentially eligible" because there is no way for us to determine if the firms have ceased claiming for the incentive. This is one reason why it is essential that the DSI work with Treasury to draw M&E reports with the data that SARS shares with Treasury. Among other benefits, it would allow DSI to determine the exact number of firms that claim in a given year (and, crucially, how much they are claiming). This is not possible with the data that the DSI currently collects.

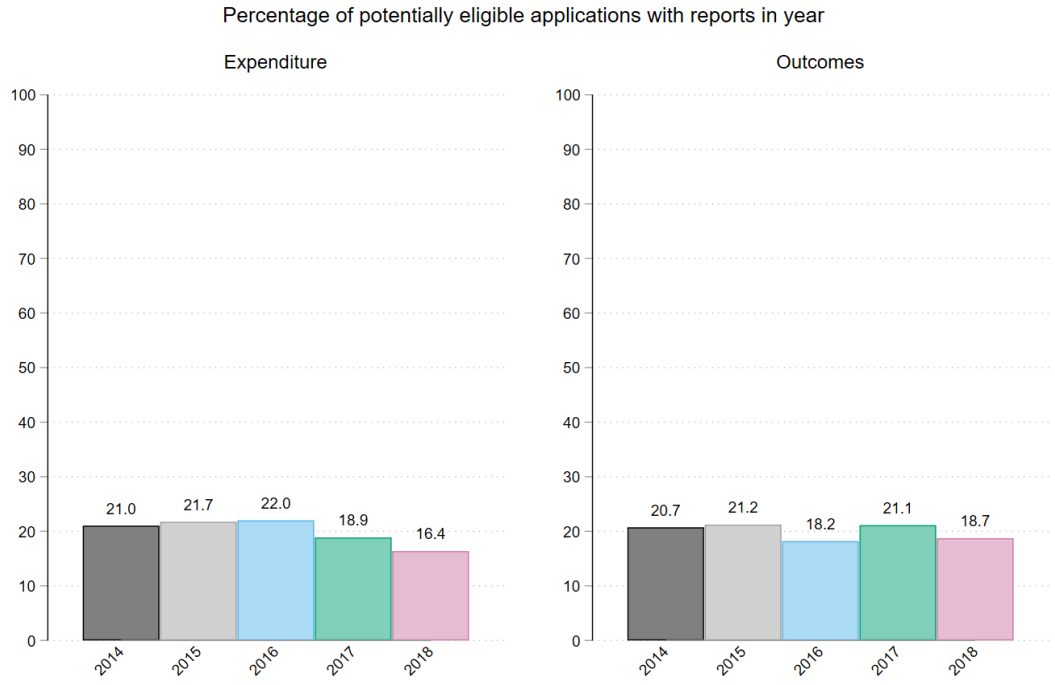
Table 10 presents the number of progress report for firms by year of application.

Given the non-random selection and poor coverage of the progress reports, it is difficult to draw inferences from the data relating to expenditure and the progress of projects. Summaries of these data for each year are presented in Table 11 and Table 12. This is one reason why we suggest that all data is gathered online, with built in checks and regulations (incentives) that promote consistency and compliance. Further, only a very few firms reported having registered patents or provided non-zero amounts for the questions relating to the Balance of Payments of the firms (export revenue). These are not reported.

In every progress report, firms self-report the outcomes from their R&D activities (it is pertinent though to pay attention to the phrasing of these questions – because some related to R&D generally and others to the tax deduction). **Error! Reference source not found.** to **Error! Reference source not found.** below present a high-level overview of the responses for the most recent report by the firm. Table 13 presents the number of reports in a year by the year of application. The data on these outcomes is disaggregated in the Appendix to this report. Notably, a majority of the firms that have submitted progress reports believe that the incentive has increased both their competitiveness and market share.

The most striking feedback, though, is that almost all the firms indicated that they would have continued with the R&D regardless of the incentive. This is one reason why, as we explain in the subsequent sections of this report, making simple before and after comparisons of the firms' outcomes will likely lead to a biased estimate of the impact of the incentive. Similarly, it is unwise to assess the impact of the programme based on feedback from beneficiaries. First, they have a financial incentive to overstate the value of the intervention – even if it not leading to any wider economic benefits. Second, it is unclear if these firms are able to accurately assess how productive they would have been without support. It is possible, for example, that the incentive merely inflated the sector-specific cost of inputs into R&D. Those firms that did not receive support may, ironically, have become more productive – because they know they have to compete with firms that are receiving the incentive. Unintended consequences such as these should form part of the ToC and, consequently, the M&E of the programme. This should form part of the planning processes related to managing the incentive.

Figure 6: Overview of progress reporting compliance



Note that we use the term "potentially eligible" because we cannot, as explained, determine if these firms are still claiming the incentive in this year (there is, as mentioned, no way for us to determine which applications have been completed).

Figure 7: Self-reported assessment of incentive on R&D in most recent progress report

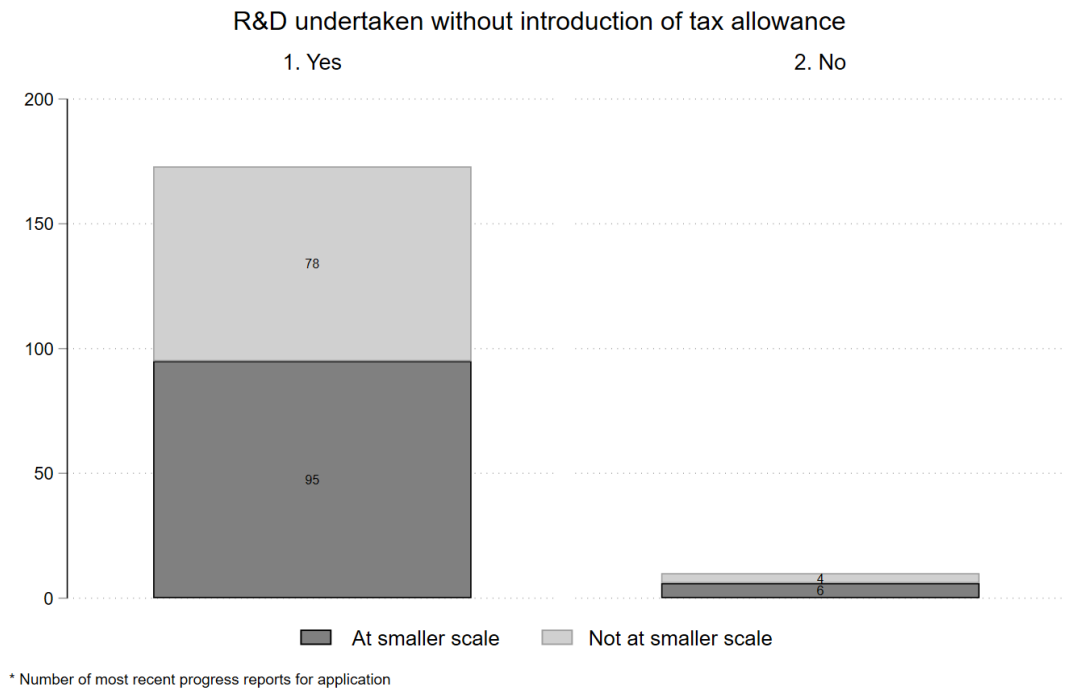


Figure 8: Self-reported assessment of R&D activities on outcomes in most recent progress report

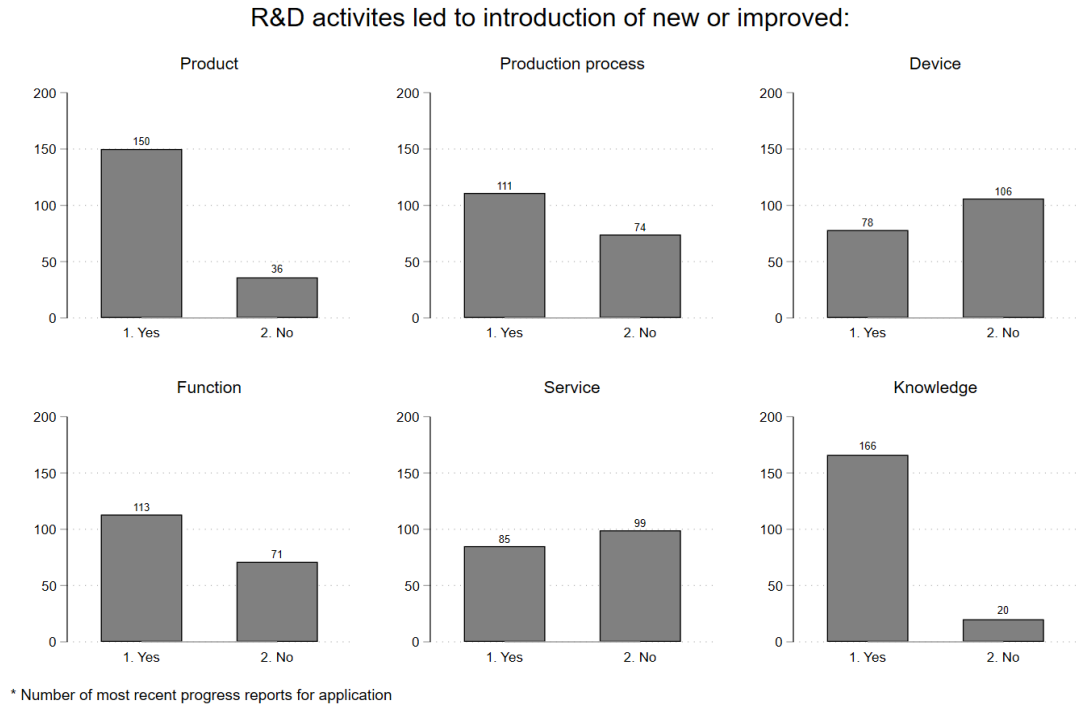
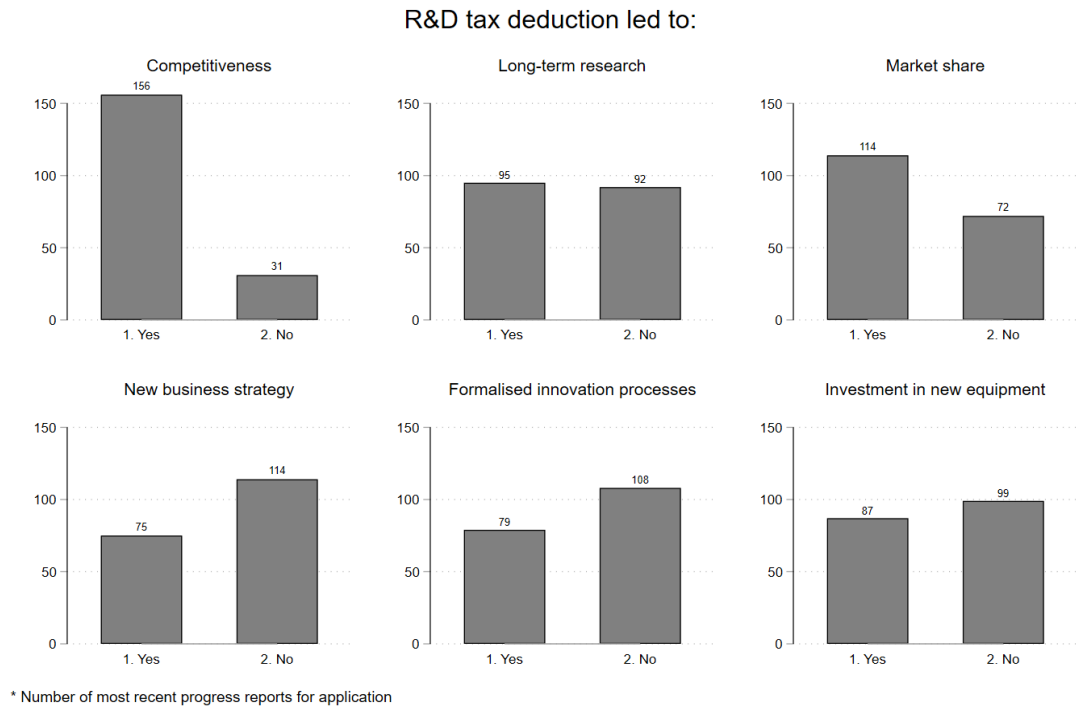


Figure 9: Self-reported assessment of R&D tax deduction on outcomes in most recent progress report



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Survey

As mentioned earlier, the outcomes listed in the progress reports cannot be used to assess the impact of the R&D Tax Incentive in South Africa because firms that are not part of the programme do not submit these reports. The study team, in collaboration with the DSI and National Treasury, consequently designed an online survey emailed to all firms that applied for the incentive. There were 136 responses, of which 90 were complete. A summary of the responses from this survey is presented in the Appendix to this report (by the primary sector of the application).

In these tables, there are two groups of firms: those that had at least one application approved or partially approved (i.e. the received the incentive) and then those firms that had none of their applications approved (no incentive). The former is the treatment group and the later will be the control group that is used to estimate the counterfactual outcomes of the beneficiaries. Again, the non-random nature of the sample makes it difficult to draw inferences about the intervention as a whole. The reader should proceed with caution when doing so. However Figure 10 through to

Figure 12 below, which present the self-reported constraints to growth through R&D for the firms that responded to these questions, suggest that the primary constraints appear to be capital and skills. While the indirect nature of the R&D tax deduction is likely to be less effective when access to capital is a binding constraint, the incentive may serve to reduce skills constraints by enabling beneficiary firms to compete with other firms for the skills that are available (including internationally).

The firms that responded to the survey also gave qualitative feedback on the incentive. The answers are, at the request of the stakeholders to this report, listed in the Appendix. While many firms were positive about the programme some firms indicated that the process took long, that the reporting requirements were onerous and that they did not always receive timely feedback from the DSI.

Figure 10: Self-reported growth constraints to investing in R&D

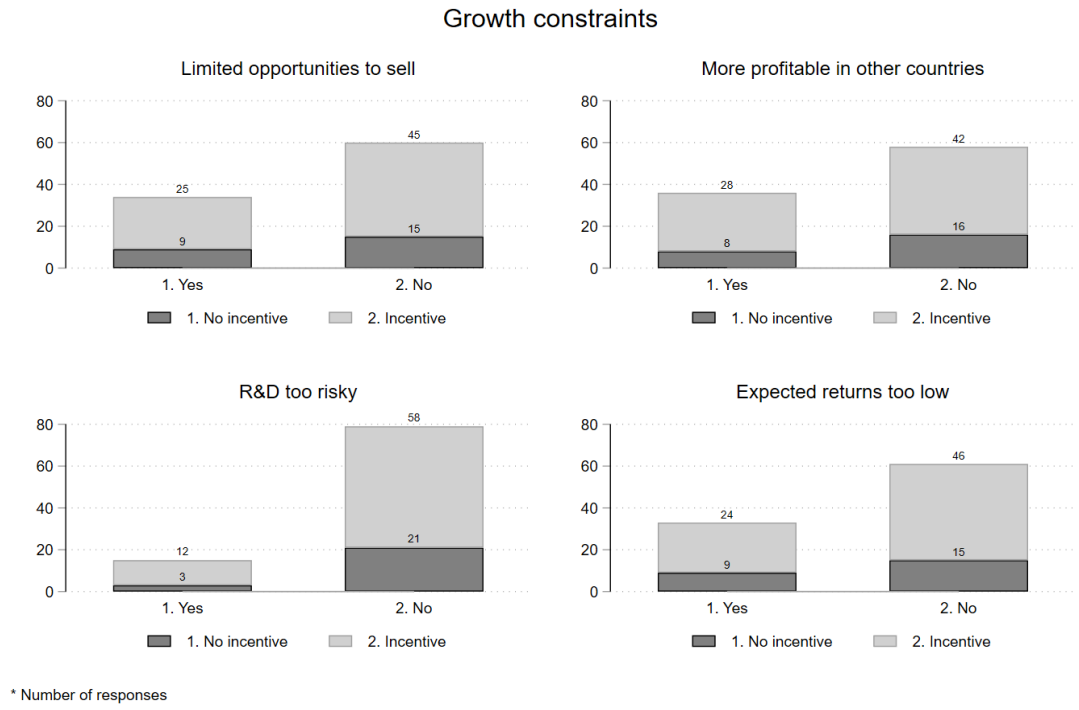
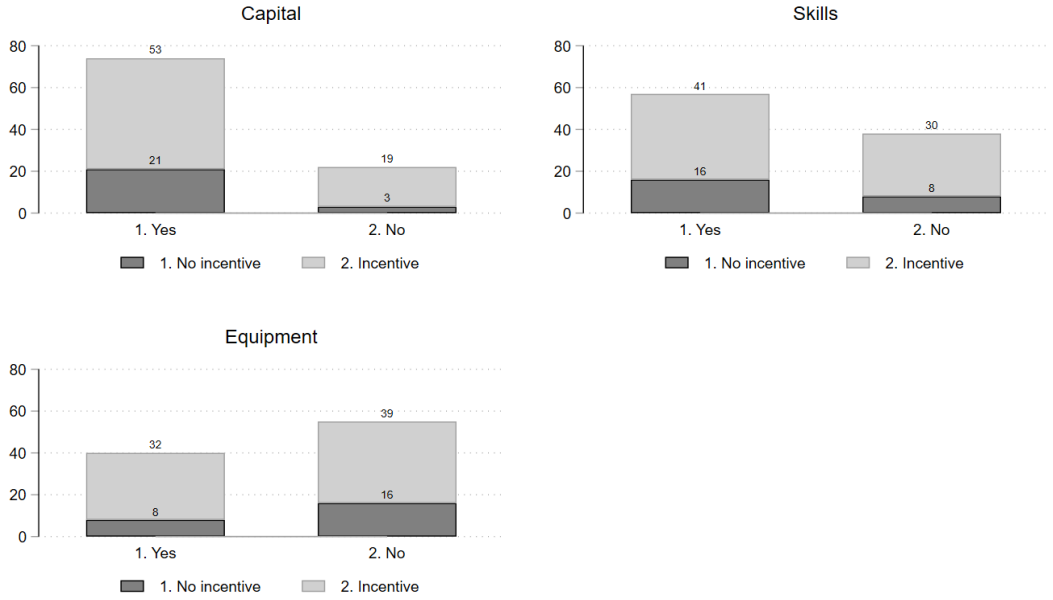


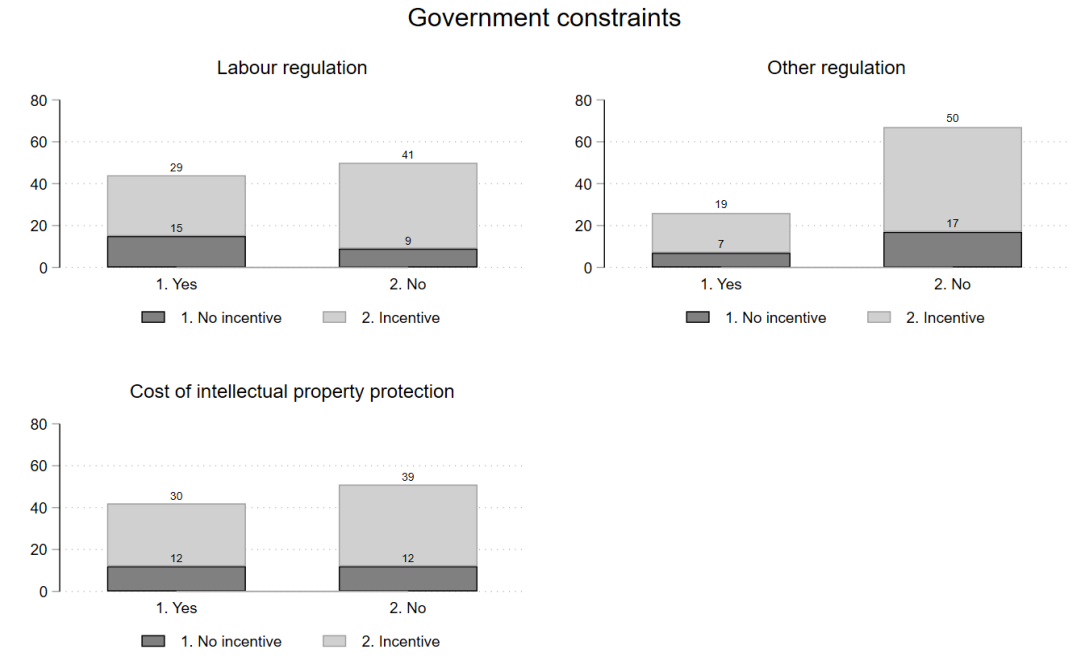
Figure 11: Self-reported resource constraints to investing in R&D

Resource constraints



* Number of responses

Figure 12: Self-reported government constraints to investing in R&D



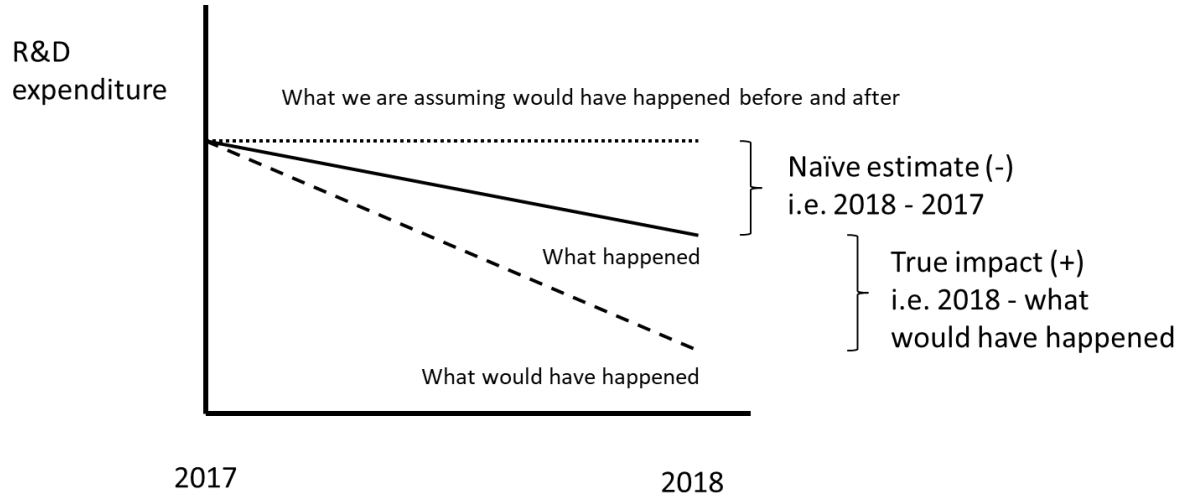
* Number of responses

Impact Evaluation

Gertler, Martinez, Premand, Rawlings and Vermeersch (2016) provide a simple and easy to understand introduction to the methods of, and issues related to, quantitative impact evaluation. In Impact Evaluation in Practice, Gertler et al. (2016) explain why making before and after comparisons may often lead to misleading estimates about the impact of policies. This is because such a comparison implicitly assumes that none of the beneficiary outcomes would have changed in the absence of any intervention.

In the figure below, suppose that a firm is approved for the incentive in 2017. In the firm's 2018 progress report, the firm reports that it is spending less on R&D than it was in 2017 (before it was eligible for the incentive, based on data from the application). Does this imply the incentive lead to the reduction in spending? No. If we compare what happened to what would have happened without the incentive, we see that, even though firm's R&D expenditure decreased, the incentive may still have had a positive impact on the level of this investment.

Figure 13: Why before and after comparisons may give us misleading estimates of the effect of the incentive



The problem we are confronted with as evaluators is that we cannot tell what would have happened to a particular firm without the incentive once it is approved for the incentive (this is also why firms can't be certain the outcomes they list in the progress reports are necessarily due to the deduction). Consider for a moment what you would be earning if you hadn't achieved the highest level of education you have? What is the impact of this education on your earnings[6]? Is it possible, for example, that you could have ended up becoming an entrepreneur? What would you be earning then?

There are fortunately a number of methods we can use to estimate the counterfactual outcomes for all the beneficiaries as a (treatment) group – if we have data for firms that are not part of the programme but that were (statistically) similar (as a group) to those firms that are treated in 2017. We call these firms the control group. If we are willing to assume that the treatment group outcomes (such as how much they spend on R&D) would, without the incentive, have ended up being approximately the same as that of the control group firms – then the

[6] Coincidently, we know very little about the causal returns to tertiary education or entrepreneurship training in South Africa – even though a considerable proportion of public resources are spent funding students. Caplan (2018) make a persuasive argument for why the returns to education are likely much lower than we believe (in his book "The case against education: Why the education system is a waste of time and money" by Princeton University Press).

difference between what subsequently happened to firms that qualified for the incentive and what happened to the firms in the control group (on average) is the effect of the incentive (e.g. on how much they spend on R&D).

In this evaluation, we use the Coarsened Exact Macthing (CEM) approach of Iacus, King, G and Porro, G. (2012). This is a very simple approach, where we compare treated and control firms that are the precisely the same in terms of the year they first applied for the incentive, the ownership structure of the firm and the primary sector of the application and then roughly the same in terms of the age of the firm and the total revenue of the firm listed in the application. The individual observations are then given weights in our estimations to balance these characteristics across the two groups.

The tables below present the results of the difference between firms that received the incentive and those that did not. They provide some statistical evidence that the incentive may have increased R&D spending and the remuneration of R&D employees. Firms that received the incentive were also less likely to regard government labour and other regulation as a constraint to R&D – perhaps because these are now less of a financial burden/risk. There were no statistically significant effects of the incentive for any of the other outcomes measured in the survey. The point estimates of the results suggest that the R&D Tax Incentive increased spending on R&D by approximately R3.5 million on average in 2017 for the firms that form part of this restricted sample from the R1.7 million the firms would likely have spent (on average) without the incentive. Thus, on average, the incentive more than doubled R&D spending for this subset of firms.

It is important to note we could only match 18 treated and 14 control firms in the survey sample that are roughly similar to each other in terms of these characteristics – all of which are privately owned in the manufacturing and business services sectors. In the Appendix to the report we present summaries of these firms. Because the sample is so small, it will not be possible to disaggregate the potential effect of the incentive to partially approved applications, for different years or by the primary sector of the application. Similarly, the results we present should not be extended to the other beneficiaries. Rather, the results we present should be interpreted as a test of the mechanism - they should not be used to assess the overall benefits and costs of the incentive.

These estimates are (in effect) what we call “Intention-to-Treat” estimates for this subsample because we do not know if the beneficiaries necessarily claimed the incentive (again, we advise that the DSI, Treasury and SARS work more closely together to develop a coherent information system that combines all the data that is being collected, including the data on the actual claims that are being made by beneficiary firms). As part of the online survey, the firms are asked if they were part of the programme. Some of the respondents that were on the DSIs records as being approved responded that they had not been approved for the incentive (and some that had not been approved believed they had been). We checked this and the most likely explanation is that the representative responding was not aware or that this representative confused the R&D incentive with one of the other incentives outlined in the DPME (2018) report. Second, it is possible that the increase in remuneration for R&D staff could be indicative of a situation where the beneficiaries are outbidding their rivals for available skills. As we noted in the previous section, the majority of the firms that responded to the survey believed that skills were a constraint to R&D in this country. It is therefore possible in principle that the control group firms’ outcomes are dependent of the outcomes of the firms that are treated. This is technically referred to as the Stable Unit Treatment Value Assumption (SUTVA). We noted earlier that the firms that submitted progress reports believed that the incentive

increased their competitiveness. Any estimate of the total cost of the programme would have to consider this. In other words, it would have to consider how firms that do not receive the incentive could be impacted negatively. We advise that this issue is considered in the ToC for the programme, as well as in the adjudication process for the applications for the incentive. Third, the null hypothesis for the tests in the tables below is that there is no effect. When we say that the effects for R&D remuneration are statistically significant at 5%, this implies that the chances of there being no real difference between these outcomes for the two samples (treatment and control) are likely small (from a statistical perspective). There is however still a chance that the effects we have identified are spurious (random). Further, for this and other reasons, the estimates we present of the effect sizes are likely imprecise. While the actual effect of the incentive is unlikely to be zero, it could be smaller or larger than R3.5 million (in the case of our estimates for R&D expenditure).

The validity of our estimates of the impact of the incentive rely on the assumption that matching the firms in the way we have provides us with a reliable estimate of the counterfactual outcomes for the beneficiary firms in the sample.

Table 3 below shows us that there are no statistically significant differences between these two groups in terms of the average turnover (at the time of the application) and average age of the firms (which was asked in the survey and does not therefore consider the impact of the intervention on firm death). We note though that these estimates of the differences are nevertheless often positive and large for the sample. Similarly, while there are no statistically significant differences between the two samples for the measures of productivity, the point estimates are not zero. Indeed, the estimates for the differences in revenue at the time of application and then for turnover in 2017 are similar.

Our sample is severely underpowered (inadequate to detect effects) to the extent that it is not possible to identify some the impact for some outcomes even when the effect sizes (such as for exports) are large. Note that we do not use the annual R&D budget, number of R&D staff or projects etc. for the purposes of matching because, unlike turnover, they are proposals. These proposals may have played a role in determining the status of the application. It is important to note that we attempted to estimate the impacts of the incentive using many different specifications and estimators. While the results varied for some of these (and it is possible, for example, to show a large increase in turnover), the results we present in the tables below are the only ones that are generally consistent across the different approaches. Given the limitations imposed by the sample size, we do not correct the standard errors for multiple hypothesis tests though.

We have restricted the sample to firms that applied prior to 2017 (because the survey questions pertain to 2017). Coincidently, the ToC for the incentive should explicitly consider how long it is likely for any investments in R&D to pay off – with the assistance of the domain experts, and the corresponding amendments to the application and progress report templates. In the case of these estimates, the effect is the average of the firms pooled from 2013 to 2016. One reason, then, why there may not be any discernible improvements in productivity is because it takes much longer for these to emerge. However, given that there are no statistical differences between many outcomes for the firms (the direction of the different point estimates for the outcomes presented in the tables also vary considerably), it is possible to argue that the selection procedure requires further consideration.

Table 3: Balance of impact evaluation sample at baseline

	(1) Total Revenue	(2) Age of firm
Incentive	10.096	2.648
	(8.169)	(2.475)
Constant	9.913	11.130***
	(6.242)	(2.061)
Observations	32	32
R-squared	0.053	0.052

*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 All amounts in R million*

Table 4: Impact of incentive on productivity for subset of firms

	(3) Profit	(4) Taxable income	(5) Turnover	(6) Exports	(7) Expenses
Incentive	2.112	-0.209	10.867	53.664	8.755
	(17.129)	(3.586)	(20.155)	(48.904)	(14.436)
Constant	4.604	4.105	29.153	5.607	24.549**
	(16.855)	(2.690)	(17.957)	(3.821)	(11.731)
Observations	32	32	32	32	32
R-squared	0.001	0.000	0.013	0.030	0.015

*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All amounts in R million.*

Table 5: Impact of the incentive on R&D expenditure for subset of firms

	(8) R&D expenditure	(9) Non R&D expenditure	(11) Remuneration	(12) R&D remuneration	(13) R&D staff
Incentive	3.623**	5.132	4.923	2.833**	3.287
	(1.483)	(13.685)	(4.804)	(1.131)	(3.743)
Constant	1.750***	22.799*	9.063***	0.946	7.213***
	(0.596)	(11.406)	(3.115)	(0.595)	(2.329)
Observations	32	32	32	32	32
R-squared	0.135	0.006	0.030	0.142	0.021

*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All amounts in R million except for staff.*

Table 6: Impact of the incentive on R&D outputs for subset of firms

	(14) Products	(15) Services	(16) Software	(17) Hardware	(18) Processes	(19) Patents domestic	(20) Patents abroad
Incentive	-0.361	-0.444	0.824	0.194	0.222	0.028	2.333
	(1.662)	(1.141)	(1.213)	(0.169)	(0.441)	(1.005)	(2.926)
Constant	2.972*	1.333	1.287*	0.083	0.333	1.250	1.167
	(1.485)	(0.987)	(0.681)	(0.059)	(0.318)	(0.737)	(0.772)
Observations	32	32	32	32	32	32	32
R-squared	0.002	0.007	0.014	0.033	0.006	0.000	0.017

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The amount refers to the number of new or improved items or patents registered.*

Table 7: Impact of the incentive on assessment of constraints to R&D for subset of firms

	(21) Labour regulation	(22) Other regulation
Incentive	-0.407**	-0.426**
	(0.171)	(0.188)
Constant	0.796***	0.704***
	(0.123)	(0.153)
Observations	32	32
R-squared	0.166	0.180

*Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The amount refers to the proportion of firms.*

Discussion and recommendations

There are presently no restrictions on the eligibility criteria of the firms that apply for the incentive (other than that they must be operating in South Africa). An analysis of the application data shows that the majority (almost 80%) of applications are for projects in the manufacturing and the business services (including financial intermediation) sectors, although the proportion of applications that are approved or partially-approved is much lower for the latter. Half of all applications are from firms with a real total revenue (in 2016 prices) of R50 million or more, and larger firms are more likely to have approved applications.

Less than a third of firms that receive the incentive submitted progress reports. It is, consequently, not possible to estimate the cost of the intervention or to draw inferences regarding the self-reported efficacy of the incentive and firms' R&D activities for the majority of participating firms. Among the firms that have submitted progress reports, almost all indicated that they would have continued with R&D without the incentive. Surprisingly, as many as 40% of these firms confirmed that they would have continued with R&D at the same scale. More than half of the firms that submitted progress reports nevertheless believe that the incentive increased their competitiveness and market share.

We use a simple ex-post matching procedure to estimate the counterfactual outcomes of the incentive beneficiaries. The estimates of the effects of the incentive on the outputs and outcomes measured in the survey, which it should be noted only extend to limited subset of privately-owned firms that received the incentive between 2013 and 2016, suggest that the incentive likely increases spending on R&D (additionality). On average, the firms in the control group sample spent approximately R1.7 million on R&D while those in the treatment group spent an additional R3.6 million (a total of R5.3 million on average). Thus, for these firms, the incentive more than doubled R&D expenditure. However, due to the small size of the sample, the evaluation is unable to demonstrate any effect on the productivity of the firms. Further, given the limitations of the data available to this study, it is not possible to assess the extent to which this is due to relabelling of other expenses or to estimate the effects of knowledge and other spillovers to firms in the industry.

Given the substantial cost of the incentive, applications for the incentive as well as all progress reports associated with approved or partially approved applications should be submitted online using a single login for the firm, which can automatically generate pre-defined reports for the purposes of M&E. Such a system could be developed together with all government departments responsible for administering the numerous business incentives outlined by the DPME (2018). In the preceding sections we noted several recommendations relating to the application and progress report form templates. It is essential that the stakeholders develop a thorough ToC for this incentive to ensure that the application forms and progress reports capture indicators that can alert planners to any obstacles. While the intervention is simple – a 150% tax deduction – the results chain is enormously complex and contingent on a number of domain and context specific hurdles.

Firms should have to reapply for the incentive every year or at least be required to submit progress reports for each project in order to roll over the incentive. Each project should be assigned a project reference number. Further, instead of submitting entirely new applications, firms should be able to apply for additional projects as part of a portfolio. The system should also automatically inform the firm's representatives of the progress of the

applications. SARS should be able to audit any claims against the information that is provided in the applications as well as the progress reports.

The DSI should introduce scoring rules to assess the applications for the incentive. This would ensure consistency and transparency in the pre-approval process, particularly when it comes to eligibility criteria like the novelty of R&D activities, for which the adjudication committee needs to decide whether the proposed innovation outputs are adequate based on a good understanding of the relevant R&D market[7]. Most R&D fiscal incentives do not include a pre-approval process, but there are other instruments to co-finance private R&D such as matching grants that make assessments about the novelty of R&D and could be used as examples to develop the scoring. The Appendix provides a short review of good practices in the design and roll out of R&D tax incentives.

The scoring rules should be based, in part, on the domain and context-specific knowledge of the experts that are currently responsible for selecting projects. It may then be possible to automate parts of the application process. These rules should explicitly consider the extent to which a project is likely to lead to spillovers or the extent to which the cost of protecting this intellectual property is prohibitive for the particular project. The application form should be amended to incorporate questions that enable these experts to do so. To this end, we must emphasize that international best practice in the management of any government program suggests that these experts and other stakeholders work together on interrogating the nuances of any theory of change (ToC) – as well as the unintended consequences – for firms operating in a particular domain pursuing particular forms of R&D, extending on the ToC for incentives outlined by the DPME (2018).

It is also advisable that the Treasury use the data that is currently shared with Treasury by SARS to provide M&E support to the DSI. This data could be used to provide the DSI with a more comprehensive overview of the cost of the program as well as answers to many of the questions that this report set out to answer (but which it could not because of the gaps in the data). Indeed, the data that SARS shares with Treasury could even be used to implement a more representative and rigorous evaluation of the impact of the R&D incentive on all of the outcomes that are currently being measured in the tax data that SARS shares with Treasury (such as the impact of the incentive on profit and employment). Ideally, it should be possible to design an ex-ante evaluation of the program going forward. This could, at a minimum, simply randomly allocate the full amount of the incentive. For example, suppose two firms apply for R 10 million each in a given year. One could be offered the full amount, and the second a marginally smaller amount such as R 9.5 million (in much the same way that some firms are partially approved, except in this case the decision is made randomly). This would allow the Treasury and DSI to determine the ROI on the 0.5 million – so that if this is sufficiently large, the program could be expanded (or, alternately, constrained). Doing this would be at the forefront of innovation in policy administration.

[7] In South Africa, the requirements in terms of the firm's R&D activities try to ensure that only "new to the world" innovation is eligible for incentives. Generally, the trend has been towards relaxing this and allow "new to the country" and "new to the firm" innovation. A study by the EU covering more than 30 countries that provide R&D incentives concludes that "new to the country" is a better practice, but there is wide divergence across developed and developing countries.

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Appendix 1: Review of good practices in the design and roll out of R&D tax incentives

Advanced economies have a long history of using tax incentives to stimulate R&D, but the design and implementation has substantial heterogeneity. R&D tax incentive schemes are widely adopted in advanced economies, including innovation leaders like the United States and Japan. Within the European Union, only Germany and Estonia currently do not have a tax policy aimed directly at stimulating innovation. Many emerging countries have also deployed similar instruments, with varying degree of success based on recent evaluations. The European Commission (2014) reviewed R&D incentives in 33 mostly advanced economies and found substantial heterogeneity across the countries with most countries offering more than one type of instrument. The study recommends best practices around three key areas of scope, targeting and organization practice (see Table below, reproduced from this review):

- **Scope** relates to the expenditure items that are covered and how the incentive is paid out. The EC study recommends that incentives use the total R&D in the tax year as basis for incentive rather than the increase between a base year and the relevant tax period to reduce administration costs and avoid triggering firms to game the system around the timing of their incentives. In order for knowledge to be transferrable between firms, it is recommended that the incentive be paid in relation to the wages of researchers and be targeted at projects that can contribute to the universal stock of knowledge rather than supporting projects that are restricted to the advancement of a firm's own state of expertise.
- With regards to **targeting**, best practice recommends that incentives be targeted towards young firms in all sectors regardless of size. This is in contrast to previous arguments that prompted many countries to target small firms. As the Organization for Economic Co-operation and Development (OECD, 2002) argues, larger firms which are responsible for the lion's share of research tend to benefit a larger proportion of R&D incentives. Targeting small firms is also based on the argument that while they are unlikely to have a significant impact on aggregate investment spending, they may contribute to innovative expenditures at the margin. However, it is younger firms (and not smaller firms per se) that drive innovation, and thus targeting shall be based on age and not size according to the EC study. Further, it is recommended that it be possible for incentives to have a carry-over facility and an option to receive a cash refund even when the innovation does not lead to profitability. This would provide firms with flexibility and certainty for investment decisions, and in particular support younger firms since they often take time to be profitable (European Commission, 2014). One risk with this approach is that established firms could split or reincorporate to gain access to the incentive.
- For easy **administrative processes** and measuring effectiveness, it is recommended that tax incentives have a one-stop online application process and systematic evaluations. The EC review recommends that feedback on qualifying expenses be provided within a year, and that countries consider immediate refunds to smaller companies in order to assist with liquidity constraints. Countries using a pre-approval selection method in particular need to ensure that their feedback is punctual so as to not delay projects. Monitoring and evaluation require that robust firm-level data that can allow for robust qualitative analysis.

Figure 14: Summary of principles of good practice (for OECD countries)

Category	Practice	Best practice	Not recommended
Scope	Input related vs. output related R&D tax incentive	Input related	Output related
	Tax credits vs. enhanced allowances	Tax credits	
	Volume-based vs. incremental	Volume-based	Incremental
	Novelty requirement	New to the country (world)	Explicit incentive for imitation
	Expenditure covered	R&D wages	IP costs
Targeting	Region	Common rate for the country	Very specific design elements in different regions
	Legal form	Common rate for all legal entities	Exclusion of firms with foreign owner
	Firm size	No targeting	Targeting at large firms
	Brackets and ceilings	No brackets	Lower rate for small amounts
	Firm age	Young firms	Incumbents
	Field of activity/type of technology	No targeting	Targeting
	Minimum	No minimum	High threshold
	Negative tax	Yes, for young firms	No negative tax
	Carry-over provisions	Yes, for young firms	No carry-over provision
	Collaboration[a]	With public research institutes	Upstream R&D cooperation between large competitors
	Generosity[b]	Ambiguous	Over-subsidizing
Organization	Decision time/refund	Minimum possible	Longer than 1 year
	Electronic application	Yes	No
	One-stop application	Yes	No
	Public consultation	Yes	No
	Evaluation	Yes, planned	No
	Synergy[a]	Complimentary	Overlapping
	Stability[a]	Fixed design and rates for at least 5 years	Large and unexpected changes in the budget

Source: European Commission (2014)

In developing countries, there are usually weaker fundamentals for innovation and limited fiscal space for the incentives, but there are also more pressing needs for innovation that can be driving competitiveness. Weaker fundamentals include for example, lack of research institutions, shortage of skilled personnel, and a weak manufacturing base. This may make it more difficult and costlier for firms to undertake R&D. This means that firms may require more generous incentives. On the other hand, limited fiscal space and the opportunity cost of using these foregone taxes on other social needs make it imperative for government incentives to result in desirable returns.

Many of the good practice principles in advanced economies apply for developing countries but these governments may consider additional principles. Starting with coverage, developing countries could consider allowing incentives for innovation that is "new to the country" but not primarily "new to the world" and cross-country projects that emphasize collaborations (taking care that there is sufficient spending in-country). An incentive available in China allows up to 40% of the qualifying R&D expenses to be incurred outside China and a VAT exemption is available to foreign firms for providing R&D, offshore outsourcing services, or transferring

technologies. In the Philippines, non-resident firms also qualify for the full R&D incentive (although it is conditional on not owning land in the Philippines) (Deloitte, 2018). Further, R&D incentives could encourage collaboration with research institutions including foreign institutions that are closer to the technological frontier.

R&D incentives linked to the salaries of researchers are recommended in advanced economies and in developing countries; they may assist domestic firms to hire foreign skilled personnel that would otherwise be too expensive. Such an incentive exists in Brazil, where firms can claim a super deduction of 160 percent of the total R&D expenditure based on the number of personnel who work on a research project exclusively (Deloitte, 2018). In India, firms can claim a super deduction on R&D expenses incurred on payments made to institutions of higher learning and research (ibid). The incentives are available to firms who claim in a year during which they made profit. Such an arrangement may foster greater transferability and spill-over of knowledge.

Governments in developing countries have made headway in introducing M&E systems that can measure effectiveness. In Mexico, qualifying firms are required to submit an annual report outlining the impact and benefits resulting from the approved R&D projects. The report must disclose the expenses incurred and investments made in connection with the authorized technological R&D project and be certified by a registered Chartered Professional Accountant (Deloitte, 2018). Firms are also required to and maintain a computer system that tracks the expenses and investment items that have been authorized and for the system to be made available on a permanent basis to government (ibid). Further, Mexican firms must also accept routine technical visits from authorities. In China, the tax authorities are required to intensify their administration of super deduction claims through regular inspections and monitoring, with audits for no less than 20% of all cases annually (Deloitte, 2018).

Several developing countries lessen the burden of the incentive by allowing for claims for failed projects to be made retroactively. Chinese firms undertaking R&D projects that span multiple years do not need to have renew the approval annually and a company may also apply for the super deduction retroactively, within three years after the expenses are incurred (Deloitte, 2018). The expenditure is deductible from gross income in the year paid or incurred and they be deferred and distributed over 5 years (ibid). The latter is conditional on fulfilling requirements such as the expenditure not being treated as an expense and being chargeable to capital account but not chargeable to property that is subject to depreciation or depletion.

Similar to advanced economies, developing countries tend to target small firms when they should be targeting young firms. For instance, Chinese SMMEs are eligible for a 175 percent super-deduction on R&D expenditure while the standard super deduction rate is 150 percent (Deloitte, 2018). And while the Mexican tax incentive has universal coverage, Mexico also offers R&D cash grants exclusively targeted at SMMEs. The potential effectiveness in South Africa is unclear because studies such as Kreuser and Newman (2018) show that large firms are currently the main drivers of innovation and productivity gains.

Appendix 2. Survey instrument

Questions in order
Q3.1 In what year was the business established?
Q3.2 In what province of South Africa (or country outside of South Africa) was the business established?
Q3.2O In what province of South Africa (or country outside of South Africa) was the business established? [Other]
Q3.3 Briefly explain the ownership structure of the business (e.g. South African privately owned multinational, Subsidiary of a foreign multinational public company, etc.).
Q3.4 In which industry(ies) does the business primarily operate?
Q3.5 What does research and development (R&D) entail in the context of your business?
Q4.1 What is your role and area of responsibility in the business?
Q5.1 In which month did your financial year end in 2017?
Q6.1 What was the total number of permanent employees in your business?
Q6.1O What was the total number of permanent employees in your business? [Other]
Q6.2 What was the total number of permanent R&D employees (i.e. personnel in R&D-related roles) in your business? If not zero, then:
Q6.2O What was the total number of permanent R&D employees (i.e. personnel in R&D-related roles) in your business? If not zero, then: [Other]
Q6.2.1. What percentage of these employees in R&D-related roles are female?
Q7.1 What was the business's total turnover?
Q7.2 What was the business's turnover from exports of goods or services to other countries?
Q7.3 What was the taxable income or loss of the business?
Q7.4 What were the total expenses of the business?
Q7.5 How much was spent on the remuneration of employees (including all benefits)?
Q7.6 How much was spent in total towards R&D? If not zero, then:
Q7.6O How much was spent in total towards R&D? If not zero, then: [Other]
Q7.6.1.1 Please indicate the percentage (as a number only that together with the other answers adds up to 100 e.g. 10) of R&D spent in respect of: [Basic Research]
Q7.6.1.2 Please indicate the percentage (as a number only that together with the other answers adds up to 100 e.g. 10) of R&D spent in respect of: [Applied Research]
Q7.6.1.3 Please indicate the percentage (as a number only that together with the other answers adds up to 100 e.g. 10) of R&D spent in respect of: [Design and development]
Q7.6.1.4 Please indicate the percentage (as a number only that together with the other answers adds up to 100 e.g. 10) of R&D spent in respect of: [Adaptation]
Q7.6.1.5 Please indicate the percentage (as a number only that together with the other answers adds up to 100 e.g. 10) of R&D spent in respect of: [Other]
Q7.6.2. How much was spent on the total remuneration (including all benefits) for employees in R&D-related roles?
Q7.6.3. How much was spent on R&D expenditure other than for labour?
Q7.6.4. What percentage of your total R&D expenditure, if any, that came from Government support grants (please enter a number e.g. 5)?
Q8.1 In the past 5 years, has your business developed any new/improved products (excluding computer hardware/software products and business processes) (Yes/No) If Yes, then:
Q8.1.1 How many?

Q8.1.2a. Are any of these new to the industry?
Q8.1.2b. Are any of these new to South Africa?
Q8.1.2c. Are any of these new to the world?
Q8.1.3 What percentage of your annual turnover currently comes from the sale of these products (e.g. 10 - please only enter a number)?
Q8.1.4 How many patents have you registered for these products in South Africa?
Q8.1.5 How many patents have you registered for these products outside of South Africa?
Q8.2 In the past 5 years, has your business developed any new/improved services (excluding online services)? (Yes/No) If Yes, then:
Q8.2.1 How many?
Q8.2.2a. Are any of these new to the industry?
Q8.2.2b. Are any of these new to South Africa?
Q8.2.2c. Are any of these new to the world?
Q8.2.3 What percentage of your annual turnover currently comes from the sale of these services (e.g. 10 - please only enter a number)?
Q8.2.4 How many patents have you registered for these services in South Africa?
Q8.2.5 How many patents have you registered for these services outside of South Africa?
Q8.3 In the past 5 years, has your business developed any new/improved computer software products? (Yes/No) If Yes, then:
Q8.3.1 How many?
Q8.3.2a. Are any of these new to the industry?
Q8.3.2b. Are any of these new to South Africa?
Q8.3.2c. Are any of these new to the world?
Q8.3.3 What percentage of your annual turnover currently comes from the sale or licensing of these computer software products (e.g. 10 - please only enter a number)?
Q8.3.4 How many patents have you registered for these computer software products or online services in South Africa?
Q8.3.5 How many patents have you registered for these computer software products or online services outside of South Africa?
Q8.4 In the past 5 years, has your business developed any new/improved computer hardware products (e.g. platform technologies)? (Yes/No) If Yes, then:
Q8.4.1 How many?
Q8.4.2a. Are any of these new to the industry?
Q8.4.2b. Are any of these new to South Africa?
Q8.4.2c. Are any of these new to the world?
Q8.4.3 What percentage of your annual turnover currently comes from the sale or licensing of these computer hardware products (e.g. 10 - please only enter a number)?
Q8.4.4 How many patents have you registered for these computer hardware products or online services in South Africa?
Q8.4.5 How many patents have you registered for these computer hardware products or online services outside of South Africa?
Q8.5 In the past 5 years, has your business developed any new/improved business processes? (Yes/No) If Yes, then:
Q8.5.1 How many?
Q8.5.2a. Are any of these new to the industry?
Q8.5.2b. Are any of these new to South Africa?

Q8.5.2c. Are any of these new to the world?
Q8.5.3 What percentage of your annual turnover currently comes from the sale or licensing of these business processes to other firms (e.g. 10 - please only enter a number)?
Q8.5.4 How many patents have you registered for these business processes in South Africa?
Q8.5.5. How many patents have you registered for these business processes outside of South Africa?
Q9.1 Industrial designs?
Q9.2 Copyrights and trademarks?
Q9.3 Plant breeder's rights?
Q9.4 Trade secrets and confidential agreements?
Q9.5 Other (Please specify)?
Q10.1.1.1 Growth opportunities for the firm? [Limited opportunities to sell new products, services or processes, etc.]
Q10.1.1.2 Growth opportunities for the firm? [More profitable R&D opportunities exist in other countries]
Q10.1.1.3 Growth opportunities for the firm? [R&D is too risky to undertake in South Africa]
Q10.1.1.4 Growth opportunities for the firm? [The expected returns from (additional) R&D are lower than sufficient to justify the investment]
Q10.1.2.1 Availability of resources for R&D? [Limited availability of capital to fund R&D]
Q10.1.2.2 Availability of resources for R&D? [Limited availability of skilled personnel to undertake the R&D]
Q10.1.2.3 Availability of resources for R&D? [Limited availability of equipment or facilities required to undertake the R&D]
Q10.1.3.1 Government constraints? [Labour market regulations make it hard to employ workers for R&D]
Q10.1.3.2 Government constraints? [Other (non-labour market) regulations (e.g. safety, health, environment, etc. regulations) restrict ability to undertake additional R&D]
Q10.1.3.3 Government constraints? [The costs of obtaining patents or other forms of intellectual property are too high]
Q10.1.4 Are there any other constraints not listed above that you would like to add?
Q11. How did you find out about the R&D tax incentive programme?
Q12. Since your company has applied for the R&D tax incentive was (were) the business's application(s) approved?
Q12.1.1 Did the business proceed with the R&D related to all the projects that were listed in the application(s) even though your application was unsuccessful? Please explain.
Q12.1.2 Has the business proceeded with the R&D related to all the projects that were listed in the application(s)? Please explain.
Q12.2 How much R&D expenditure did your business submit in its tax returns for the incentive in the financial year ending in 2017 (in Rand using only a number with no spaces between the digits and no R e.g. 1000000)?
Q12.3 Could you briefly describe your experience of the R&D tax incentive (whether in respect of claiming or reporting), including any suggestions for improvement or concerns you may have?
Q13. Since 2012, has your business applied for any other (than the R&D tax incentive) government support towards R&D in your business?
Q13.1. Would you briefly describe the support the business applied for and whether the application(s) was, (were) approved?
Q14. Would you like to add any further information you think would be relevant for the evaluation of the policies to support R&D for businesses in South Africa?

Appendix 3. Additional tables and figures

Figure 15: Percentage of applications by primary sector of application

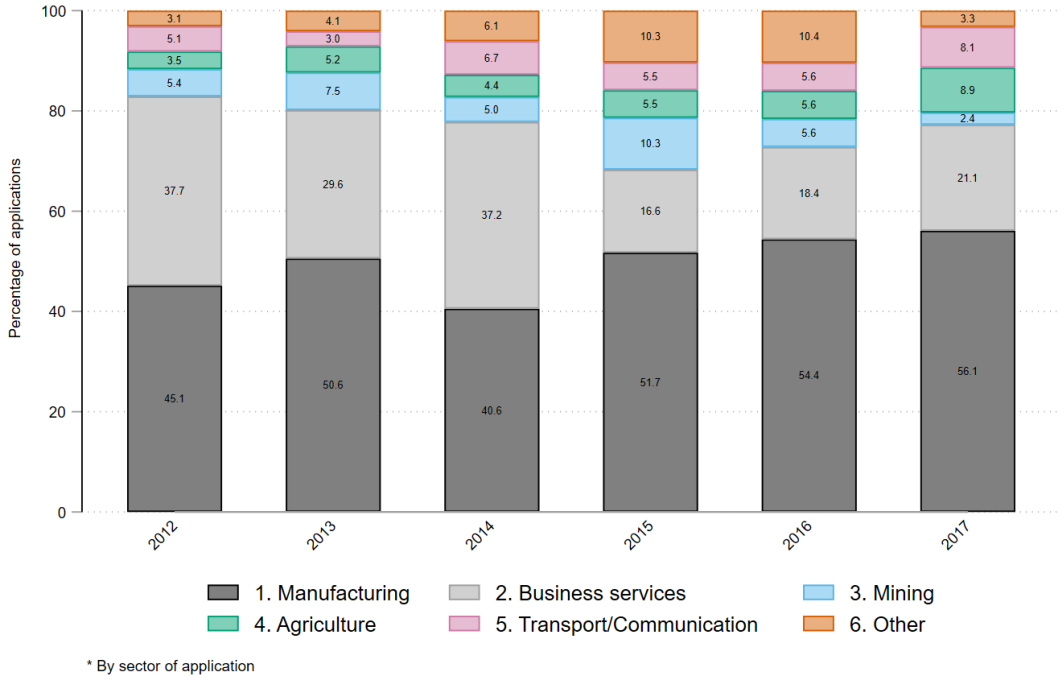


Figure 16: Percentage of applications by revenue of firm (real, in 2016 prices) category

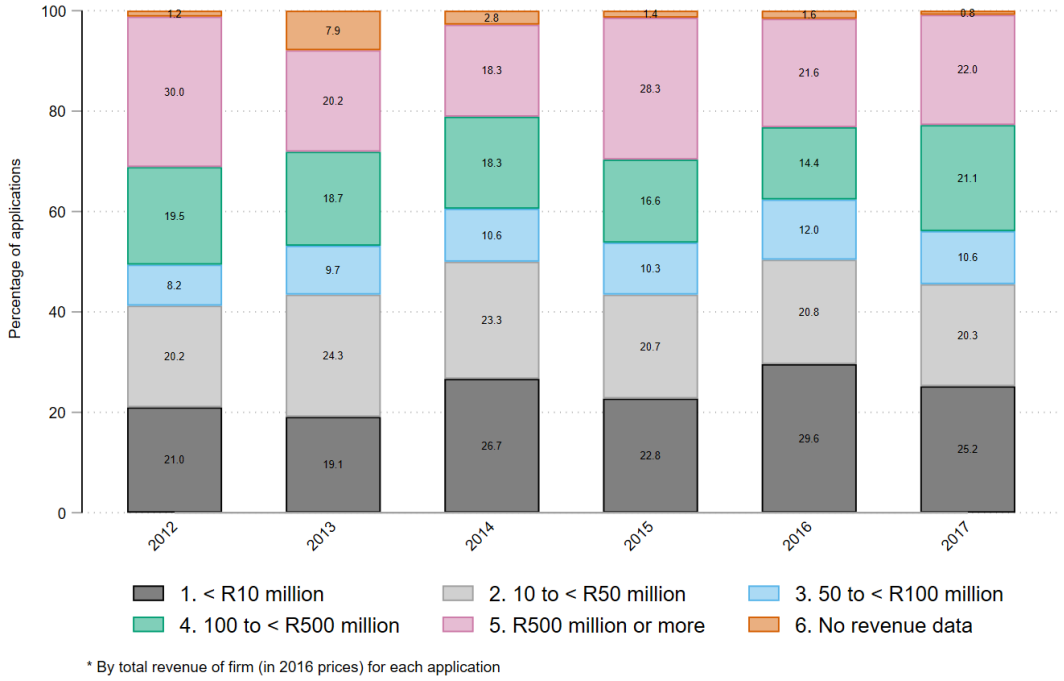
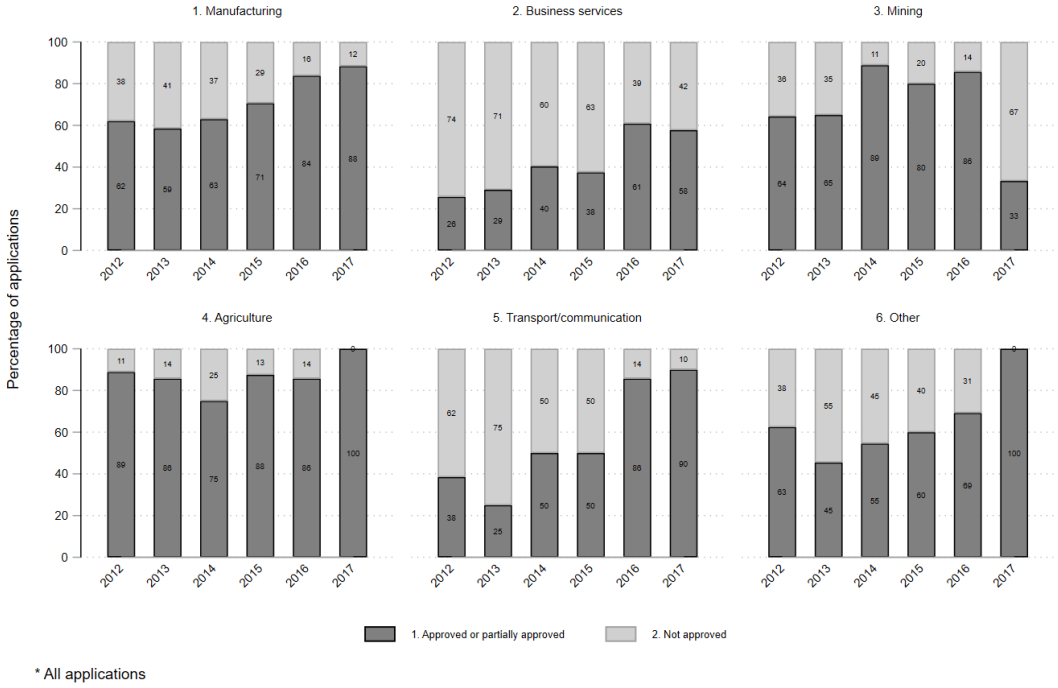
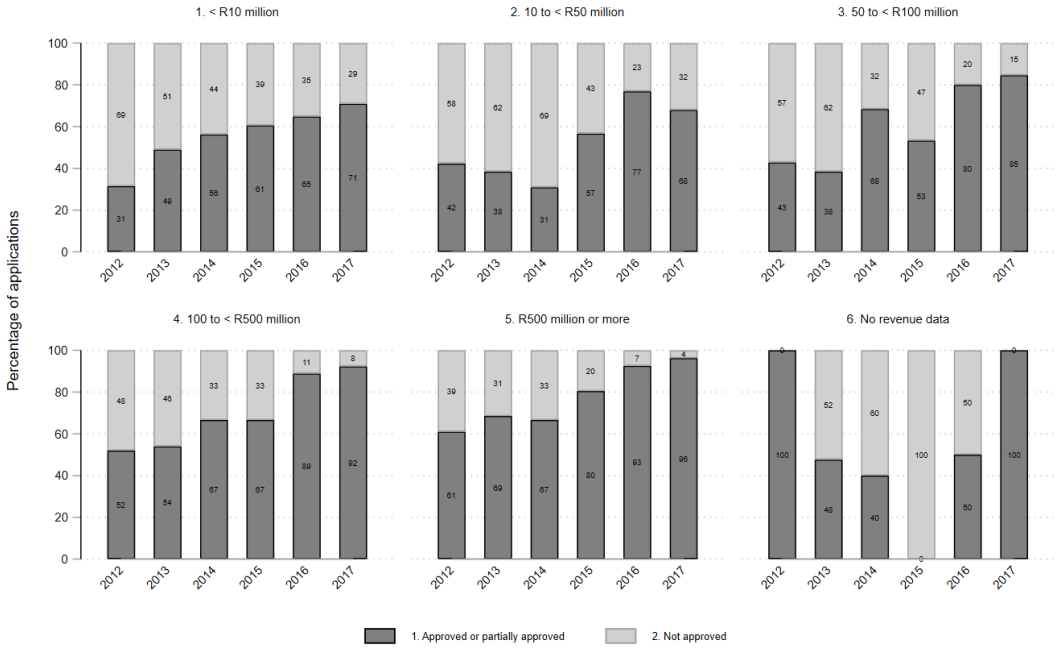


Figure 17: Percentage of approved or partially approved (or not approved) applications by primary sector of application



* All applications

Figure 18: Percentage of approved or partially approved (or not approved) applications by firm revenue (real, in 2016 prices) category



* All applications

Table 8: Summary of application data by primary sector of application

Number of applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	116	135	73	75	68	69	536
2. Business services	97	79	67	24	23	26	316
3. Mining	14	20	9	15	7	3	68
4. Agriculture	9	14	8	8	7	11	57
5. Transport/communication	13	8	12	8	7	10	58
6. Other	8	11	11	15	13	4	62
Total	257	267	180	145	125	123	1097

Percentage of applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	45	51	41	52	54	56	49
2. Business services	38	30	37	17	18	21	29
3. Mining	5	7	5	10	6	2	6
4. Agriculture	4	5	4	6	6	9	5
5. Transport/communication	5	3	7	6	6	8	5
6. Other	3	4	6	10	10	3	6
Total	100	100	100	100	100	100	100

Median of the firms' annual R&D budget for all applications in R million by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	8.1	5.6	6.8	7.6	10.0	6.2	7.0
2. Business services	4.5	3.1	3.9	4.5	4.6	5.8	4.0
3. Mining	50.0	6.0	15.0	10.0	17.5	150.0	14.6
4. Agriculture	19.8	2.5	1.6	5.3	1.0	1.7	2.6
5. Transport/communication	6.0	5.1	8.0	3.2	1.3	17.5	8.0
6. Other	3.6	3.4	1.8	5.5	3.9	4.0	3.6
Total	6.7	4.2	4.7	5.6	5.0	6.0	5.4

Median number of R&D staff for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	8.0	8.0	6.0	8.0	7.0	0.0	7.0
2. Business services	8.0	7.0	9.0	7.5	8.0	0.0	7.0
3. Mining	7.5	5.5	10.0	7.0	5.0	0.0	7.0
4. Agriculture	30.0	8.5	5.0	2.5	2.0	0.0	4.0
5. Transport/communication	8.0	9.5	6.0	6.5	4.0	0.0	6.0
6. Other	5.5	9.0	5.0	9.0	15.0	0.0	7.0
Total	8.0	8.0	6.5	7.0	7.0	0.0	7.0

Average number of R&D staff for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	22.5	16.9	10.1	21.1	25.0	7.6	17.6

2. Business services	17.0	12.6	13.5	11.5	10.2	3.6	13.1
3. Mining	20.8	11.9	25.4	6.8	9.1	2.3	13.7
4. Agriculture	26.6	11.5	7.8	3.3	4.9	3.7	9.9
5. Transport/communication	17.0	19.5	5.8	6.9	8.0	0.7	9.7
6. Other	8.0	21.8	7.9	15.0	20.5	0.8	14.3
Total	19.8	15.3	11.6	15.6	18.8	5.5	15.1

Average number of Scientists for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	2.0	1.9	1.2	1.4	2.7	0.8	1.7
2. Business services	0.5	0.4	1.3	0.5	1.8	0.3	0.7
3. Mining	1.0	0.9	0.3	0.4	0.0	0.0	0.6
4. Agriculture	5.9	2.7	2.3	1.5	0.7	0.6	2.3
5. Transport/communication	0.2	0.6	0.0	0.3	1.6	0.0	0.3
6. Other	0.1	2.3	1.4	2.0	0.7	0.3	1.3
Total	1.4	1.4	1.2	1.1	2.0	0.6	1.3

Average number of Engineers for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	5.0	3.5	2.0	5.8	3.4	0.7	3.6
2. Business services	2.5	2.6	2.3	2.4	1.8	2.1	2.4
3. Mining	5.6	3.5	4.4	2.9	3.3	1.7	3.8
4. Agriculture	0.9	0.5	0.3	0.0	0.3	0.3	0.4
5. Transport/communication	3.6	2.8	3.5	1.9	1.1	0.5	2.4
6. Other	2.3	11.7	3.1	4.3	3.5	0.3	4.7
Total	3.8	3.4	2.3	4.2	2.8	0.9	3.1

Average number of Technologists for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	2.8	1.5	1.4	1.7	2.5	0.6	1.8
2. Business services	5.9	3.1	3.1	2.6	2.8	0.0	3.6
3. Mining	2.7	1.1	3.1	0.2	0.6	0.0	1.4
4. Agriculture	0.9	0.4	0.5	0.3	0.0	0.4	0.4
5. Transport/communication	1.5	1.4	0.2	0.6	0.3	0.1	0.7
6. Other	0.1	1.5	0.9	3.2	2.8	0.0	1.8
Total	3.7	1.9	1.9	1.7	2.2	0.4	2.2

Average number of Technicians for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	3.9	5.2	1.6	5.2	6.3	2.3	4.2
2. Business services	1.8	1.4	1.6	1.5	1.3	0.1	1.4
3. Mining	3.5	1.1	2.3	1.1	1.1	0.0	1.7
4. Agriculture	3.6	0.5	1.6	0.1	1.6	0.5	1.2
5. Transport/communication	2.8	6.9	1.3	2.3	0.1	0.0	2.2
6. Other	0.9	2.5	1.0	3.0	1.2	0.0	1.7

Total	2.9	3.4	1.6	3.5	3.9	1.3	2.8

Average number of Managers for all applications by year of application

Primary sector of the application	2012	2013	2014	2015	2016	2017	Total
1. Manufacturing	2.6	1.4	1.6	2.6	2.4	1.1	1.9
2. Business services	2.2	1.5	1.3	1.7	1.3	0.5	1.6
3. Mining	1.6	2.5	2.6	0.9	1.1	0.7	1.7
4. Agriculture	1.3	0.9	0.6	0.5	0.6	0.4	0.7
5. Transport/communication	3.6	3.3	0.8	1.3	1.6	0.1	1.8
6. Other	3.0	1.2	0.9	1.5	3.1	0.3	1.8
Total	2.4	1.5	1.4	1.9	2.1	0.8	1.7

Table 9: Summary of application data by firm revenue (real, in 2016 prices) category

Number of applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	54	51	48	33	37	31	254
2. 10 to < R50 million	52	65	42	30	26	25	240
3. 50 to < R100 million	21	26	19	15	15	13	109
4. 100 to < R500 million	50	50	33	24	18	26	201
5. R500 million or more	77	54	33	41	27	27	259
6. No revenue data	3	21	5	2	2	1	34
Total	257	267	180	145	125	123	1097

Percentage of applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	21	19	27	23	30	25	23
2. 10 to < R50 million	20	24	23	21	21	20	22
3. 50 to < R100 million	8	10	11	10	12	11	10
4. 100 to < R500 million	19	19	18	17	14	21	18
5. R500 million or more	30	20	18	28	22	22	24
6. No revenue data	1	8	3	1	2	1	3
Total	100	100	100	100	100	100	100

Median of the firms' annual R&D budget for all applications in R million by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	1.4	1.9	1.3	2.3	2.0	1.4	1.6
2. 10 to < R50 million	3.6	2.5	3.0	2.7	4.0	2.6	3.0
3. 50 to < R100 million	4.7	4.6	6.0	5.0	4.6	6.7	5.0
4. 100 to < R500 million	9.8	7.2	8.0	6.5	9.0	7.7	8.0
5. R500 million or more	40.0	12.7	25.2	25.8	35.0	26.3	27.5
6. No revenue data	28.9	28.9	22.0	0.5		23.0	28.7
Total	6.7	4.2	4.7	5.6	5.0	6.0	5.4

Median number of R&D staff for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	4.0	6.0	4.0	6.0	6.0	0.0	4.0
2. 10 to < R50 million	7.0	6.0	7.5	7.0	8.0	0.0	7.0
3. 50 to < R100 million	10.0	7.0	12.0	8.0	7.0	0.0	8.0
4. 100 to < R500 million	11.0	9.0	8.0	8.0	8.0	0.0	8.0
5. R500 million or more	14.0	13.0	7.0	7.0	7.0	0.0	9.0
6. No revenue data	2.0	8.0	4.0	3.5	25.5	0.0	7.0
Total	8.0	8.0	6.5	7.0	7.0	0.0	7.0

Average number of R&D staff for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	9.6	6.9	7.3	10.1	9.3	3.0	7.8

2. 10 to < R50 million	16.8	11.2	9.5	13.8	42.6	9.1	15.6
3. 50 to < R100 million	14.5	16.8	18.3	17.9	10.3	13.2	15.4
4. 100 to < R500 million	19.6	15.0	12.5	12.6	17.8	2.7	14.1
5. R500 million or more	31.0	28.2	16.8	23.0	13.9	4.1	22.8
6. No revenue data	3.3	13.6	5.4	3.5	25.5	0.0	11.2
Total	19.8	15.3	11.6	15.6	18.8	5.5	15.1

Average number of Scientists for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	1.7	1.0	0.8	1.5	1.1	0.3	1.1
2. 10 to < R50 million	0.7	0.8	1.0	0.5	4.5	0.6	1.1
3. 50 to < R100 million	0.2	4.2	1.4	1.2	0.4	1.1	1.6
4. 100 to < R500 million	0.8	1.2	1.5	0.5	1.4	0.4	1.0
5. R500 million or more	2.3	1.8	1.5	1.7	1.4	0.9	1.7
6. No revenue data	1.3	0.7	0.0	0.0	10.0	0.0	1.1
Total	1.4	1.4	1.2	1.1	2.0	0.6	1.3

Average number of Engineers for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	1.7	1.7	1.8	3.1	2.2	1.2	1.9
2. 10 to < R50 million	1.7	2.5	2.4	3.4	1.7	1.6	2.2
3. 50 to < R100 million	3.6	2.8	3.1	1.4	2.7	0.3	2.5
4. 100 to < R500 million	4.4	3.0	1.8	3.8	2.7	0.6	2.9
5. R500 million or more	6.4	6.0	3.4	7.2	4.9	0.8	5.3
6. No revenue data	0.3	4.9	0.8	1.0	1.5	0.0	3.3
Total	3.8	3.4	2.3	4.2	2.8	0.9	3.1

Average number of Technologists for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	2.1	1.2	0.4	0.9	1.2	0.1	1.1
2. 10 to < R50 million	5.0	1.2	1.9	1.9	4.2	0.8	2.5
3. 50 to < R100 million	1.5	0.7	4.1	2.7	1.9	1.1	1.9
4. 100 to < R500 million	3.0	2.2	2.5	0.4	3.4	0.1	2.1
5. R500 million or more	5.2	3.9	2.6	2.6	1.4	0.3	3.3
6. No revenue data	0.7	1.3	0.2	0.0	0.0	0.0	0.9
Total	3.7	1.9	1.9	1.7	2.2	0.4	2.2

Average number of Technicians for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	1.5	1.0	1.3	2.1	1.9	0.2	1.3
2. 10 to < R50 million	1.6	1.3	1.0	2.4	11.7	2.3	2.7
3. 50 to < R100 million	1.2	1.1	2.6	2.5	1.6	4.4	2.0
4. 100 to < R500 million	3.8	2.8	2.0	1.3	0.3	0.8	2.3
5. R500 million or more	4.7	10.3	1.5	7.1	2.2	0.7	5.2
6. No revenue data	0.0	2.9	3.0	2.0	14.0	0.0	3.1

Total	2.9	3.4	1.6	3.5	3.9	1.3	2.8

Average number of Managers for all applications by year of application

Firm revenue in real R million	2012	2013	2014	2015	2016	2017	Total
1. < R10 million	0.7	0.8	0.5	1.4	0.9	0.3	0.8
2. 10 to < R50 million	1.9	1.3	1.1	1.6	3.8	1.5	1.7
3. 50 to < R100 million	2.0	1.0	2.4	3.3	1.8	1.9	2.0
4. 100 to < R500 million	2.3	1.3	2.3	1.9	2.9	0.2	1.8
5. R500 million or more	4.2	2.8	1.7	2.2	1.8	0.6	2.6
6. No revenue data	1.0	1.8	0.8	0.5	0.0	0.0	1.3
Total	2.4	1.5	1.4	1.9	2.1	0.8	1.7

Table 10: Number of progress reports submitted to the DSI

Progress reports for expenditure by year of application

Number matched	2012	2013	2014	2015	2016	2017	Total
0	59	77	71	60	84	96	447
1	17	30	21	26	13	5	112
2	25	13	7	9	2	0	56
3	14	7	2	0	0	0	23
4	8	12	0	0	0	0	20
5	4	0	0	0	0	0	4
Total	127	139	101	95	99	101	662

Progress reports for outcomes by year of application

Number matched	2012	2013	2014	2015	2016	2017	Total
0	61	85	75	67	85	96	469
1	19	28	19	19	13	5	103
2	25	13	7	8	1	0	54
3	12	7	0	1	0	0	20
4	7	6	0	0	0	0	13
5	3	0	0	0	0	0	3
Total	127	139	101	95	99	101	662

Table 11: Summary of R&D expenditure data in progress reports by year of application and year of report

Year				R&D Expenditure in R million				
Application	**Report**	*Applications*	*Projects*	Approved	Eligible incurred	Outside SA	Other	Total
2012	**2013**	*50*	*16*	7209	1043	69	511	1614
2012	**2014**	*41*	*121*	6845	888	44	185	1094
2012	**2015**	*28*	*168*	6800	524	47	109	565
2012	**2016**	*29*	*214*	383	417	2	618	1038
2012	**2017**	*15*	*107*	346	560	0	71	632
2012	**2018**	*5*	*20*	73	53	0	1	54
2013	**2013**	*16*	*0*	365	317	14	41	372
2013	**2014**	*41*	*37*	1646	1004	39	493	1538
2013	**2015**	*31*	*61*	1088	663	257	524	1434
2013	**2016**	*26*	*219*	1145	622	209	380	1210
2013	**2017**	*18*	*64*	1114	535	290	646	1202
2013	**2018**	*2*	*3*	3	1	0	7	9
2014	**2014**	*5*	*0*	45	41	0	5	46
2014	**2015**	*18*	*8*	1803	208	0	113	321
2014	**2016**	*16*	*21*	1304	193	0	84	277
2014	**2017**	*6*	*9*	1156	121	0	96	217
2014	**2018**	*1*	*6*	0	15	0	32	47
2015	**2015**	*7*	*10*	311	111	0	57	168
2015	**2016**	*27*	*89*	525	200	1	65	266
2015	**2017**	*12*	*20*	145	45	0	55	100
2015	**2018**	*2*	*2*	26	230	0	0	230
2016	**2016**	*7*	*6*	106	76	0	6	67
2016	**2017**	*8*	*4*	59	30	0	6	37
2016	**2018**	*3*	*7*	40	29	0	11	40
2017	**2017**	*4*	*0*	137	20	0	11	31
2017	**2018**	*0*	*0*	0	0	0	0	0

Table 12: Summary of the status of projects data by year of application and year of report

Year				Percentage of projects				
Application	**Report**	*Applications*	*Projects*	Complete	Ongoing	On hold	Terminated	Other
2012	**2014**	*34*	*138*	17	79	1	1	2
2012	**2015**	*34*	*232*	9	76	3	0	10
2012	**2016**	*34*	*332*	13	73	2	0	12
2012	**2017**	*28*	*228*	28	62	4	0	7
2012	**2018**	*27*	*159*	19	69	9	0	3
2013	**2014**	*14*	*41*	10	78	12	0	0
2013	**2015**	*28*	*82*	18	71	6	2	2
2013	**2016**	*29*	*259*	19	69	3	1	8
2013	**2017**	*29*	*171*	17	71	6	4	2
2013	**2018**	*25*	*95*	7	82	1	7	2
2014	**2015**	*4*	*8*	0	100	0	0	0
2014	**2016**	*10*	*27*	0	96	0	0	4
2014	**2017**	*16*	*163*	34	59	1	7	0
2014	**2018**	*11*	*31*	39	52	10	0	0
2015	**2015**	*3*	*10*	20	80	0	0	0
2015	**2016**	*11*	*128*	2	16	0	0	83
2015	**2017**	*14*	*272*	18	72	3	7	0
2015	**2018**	*16*	*38*	3	95	3	0	0
2016	**2016**	*4*	*7*	0	71	29	0	0
2016	**2017**	*3*	*7*	0	71	29	0	0
2016	**2018**	*10*	*31*	16	77	6	0	0
2017	**2017**	*1*	*37*	14	76	3	8	0
2017	**2018**	*4*	*8*	0	100	0	0	0

Table 13: Most recent progress report by year of application

Firm’s most recent progress report for expenditure by year of application

Year submitted	2012	2013	2014	2015	2016	2017	Total
2014	9	4	0	0	0	0	13
2015	5	7	1	3	0	0	16
2016	13	8	6	10	3	0	40
2017	14	18	12	6	2	1	53
2018	27	25	11	16	10	4	93
Total	68	62	30	35	15	5	215

Firm's most recent progress report for outcomes by year of application

Year submitted	2012	2013	2014	2015	2016	2017	Total
2014	10	2	0	0	0	0	12
2015	6	7	1	1	0	0	15
2016	12	6	3	3	0	0	24
2017	18	15	11	7	1	0	52
2018	20	24	11	17	13	5	90
Total	66	54	26	28	14	5	193

Table 14: Self-reported outcomes data from most recent progress reports by primary sector of the application

Number of outcome progress reports by year of most recent report

Primary sector of the application	2014	2015	2016	2017	2018	Total
1. Manufacturing	8	7	15	30	47	107
2. Business services	0	3	3	8	20	34
3. Mining	1	3	2	4	5	15
4. Agriculture	0	2	2	5	6	15
5. Transport/communication	1	0	1	2	6	10
6. Other	2	0	1	3	6	12
Total	12	15	24	52	90	193

R&D undertaken without introduction of tax allowance

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	8	92	100
2. Business services	3	97	100
3. Mining	0	100	100
4. Agriculture	0	100	100
5. Transport/communication	10	90	100
6. Other	0	100	100

Without the Tax Incentive, R&D activities would have proceeded at smaller scale

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	50	50	100
2. Business services	25	75	100
3. Mining	47	53	100
4. Agriculture	53	47	100
5. Transport/communication	40	60	100
6. Other	33	67	100

R&D activities led introduction of new or improved production processes

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	39	61	100
2. Business services	48	52	100
3. Mining	40	60	100
4. Agriculture	33	67	100
5. Transport/communication	50	50	100
6. Other	27	73	100

R&D activities led introduction of new or improved device

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			

1. Manufacturing	51	49	100
2. Business services	69	31	100
3. Mining	53	47	100
4. Agriculture	73	27	100
5. Transport/communication	50	50	100
6. Other	73	27	100

R&D activities led introduction of new or improved function

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	38	62	100
2. Business services	22	78	100
3. Mining	73	27	100
4. Agriculture	62	38	100
5. Transport/communication	40	60	100
6. Other	17	83	100

R&D activities led introduction of new or improved service

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	61	39	100
2. Business services	48	52	100
3. Mining	67	33	100
4. Agriculture	47	53	100
5. Transport/communication	10	90	100
6. Other	33	67	100

R&D activities led introduction of new or improved knowledge

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	8	92	100
2. Business services	22	78	100
3. Mining	13	87	100
4. Agriculture	13	87	100
5. Transport/communication	0	100	100
6. Other	9	91	100

R&D tax deduction led to investment in new equipment

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	53	47	100
2. Business services	45	55	100
3. Mining	47	53	100
4. Agriculture	60	40	100
5. Transport/communication	90	10	100

6. Other	40	60	100

R&D tax deduction led to increased competitiveness

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	18	82	100
2. Business services	13	88	100
3. Mining	33	67	100
4. Agriculture	7	93	100
5. Transport/communication	0	100	100
6. Other	17	83	100

R&D tax deduction led to increased market share

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	39	61	100
2. Business services	31	69	100
3. Mining	60	40	100
4. Agriculture	40	60	100
5. Transport/communication	30	70	100
6. Other	36	64	100

R&D tax deduction led to change in business strategy

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	64	36	100
2. Business services	58	42	100
3. Mining	60	40	100
4. Agriculture	47	53	100
5. Transport/communication	40	60	100
6. Other	67	33	100

R&D tax deduction led to formalised innovation processes

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			
1. Manufacturing	59	41	100
2. Business services	59	41	100
3. Mining	60	40	100
4. Agriculture	47	53	100
5. Transport/communication	70	30	100
6. Other	45	55	100

R&D tax deduction led to research undertaken beyond short-term business needs

Primary sector of the application	No	Yes	Total
Percentage of most recent progress report			

1. Manufacturing	57	43	100
2. Business services	36	64	100
3. Mining	50	50	100
4. Agriculture	47	53	100
5. Transport/communication	30	70	100
6. Other	33	67	100

Table 15: Self--reported outcomes data from most recent progress reports by revenue (real, in 2016 prices) category of the firm

Number of outcome progress reports by year of most recent report

Firm revenue in real R million	2014	2015	2016	2017	2018	Total
1. < R10 million	3	3	2	7	17	32
2. 10 to < R50 million	2	6	4	5	19	36
3. 50 to < R100 million	1	2	3	6	4	16
4. 100 to < R500 million	2	0	7	11	20	40
5. R500 million or more	3	4	8	22	30	67
6. No revenue data	1	0	0	1	0	2
Total	12	15	24	52	90	193

R&D undertaken without introduction of tax allowance

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	13	87	100
2. 10 to < R50 million	3	97	100
3. 50 to < R100 million	13	88	100
4. 100 to < R500 million	3	97	100
5. R500 million or more	3	97	100
6. No revenue data	0	100	100

Without the Tax Incentive, R&D activities would have proceeded at smaller scale

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	34	66	100
2. 10 to < R50 million	18	82	100
3. 50 to < R100 million	36	64	100
4. 100 to < R500 million	46	54	100
5. R500 million or more	65	35	100
6. No revenue data	0	100	100

R&D activities led introduction of new or improved production processes

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	39	61	100
2. 10 to < R50 million	53	47	100
3. 50 to < R100 million	44	56	100
4. 100 to < R500 million	31	69	100
5. R500 million or more	38	62	100
6. No revenue data	50	50	100

R&D activities led introduction of new or improved device

Firm revenue in real R million	No	Yes	Total

Percentage of most recent progress report			
1. < R10 million	50	50	100
2. 10 to < R50 million	67	33	100
3. 50 to < R100 million	75	25	100
4. 100 to < R500 million	38	62	100
5. R500 million or more	66	34	100
6. No revenue data	0	100	100

R&D activities led introduction of new or improved function

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	38	63	100
2. 10 to < R50 million	35	65	100
3. 50 to < R100 million	19	81	100
4. 100 to < R500 million	34	66	100
5. R500 million or more	48	52	100
6. No revenue data	50	50	100

R&D activities led introduction of new or improved service

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	52	48	100
2. 10 to < R50 million	42	58	100
3. 50 to < R100 million	38	63	100
4. 100 to < R500 million	63	37	100
5. R500 million or more	58	42	100
6. No revenue data	100	0	100

R&D activities led introduction of new or improved knowledge

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	16	84	100
2. 10 to < R50 million	19	81	100
3. 50 to < R100 million	13	88	100
4. 100 to < R500 million	8	92	100
5. R500 million or more	6	94	100
6. No revenue data	0	100	100

R&D tax deduction led to investment in new equipment

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	41	59	100
2. 10 to < R50 million	42	58	100
3. 50 to < R100 million	56	44	100
4. 100 to < R500 million	41	59	100

5. R500 million or more	72	28	100
6. No revenue data	50	50	100

R&D tax deduction led to increased competitiveness

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	9	91	100
2. 10 to < R50 million	12	88	100
3. 50 to < R100 million	6	94	100
4. 100 to < R500 million	11	89	100
5. R500 million or more	29	71	100
6. No revenue data	0	100	100

R&D tax deduction led to increased market share

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	44	56	100
2. 10 to < R50 million	36	64	100
3. 50 to < R100 million	25	75	100
4. 100 to < R500 million	24	76	100
5. R500 million or more	51	49	100
6. No revenue data	0	100	100

R&D tax deduction led to change in business strategy

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	50	50	100
2. 10 to < R50 million	39	61	100
3. 50 to < R100 million	56	44	100
4. 100 to < R500 million	65	35	100
5. R500 million or more	73	27	100
6. No revenue data	100	0	100

R&D tax deduction led to formalised innovation processes

Firm revenue in real R million	No	Yes	Total
Percentage of most recent progress report			
1. < R10 million	61	39	100
2. 10 to < R50 million	50	50	100
3. 50 to < R100 million	56	44	100
4. 100 to < R500 million	55	45	100
5. R500 million or more	64	36	100
6. No revenue data	0	100	100

R&D tax deduction led to research undertaken beyond short-term business needs

Firm revenue in real R million	No	Yes	Total

Percentage of most recent progress report			
1. < R10 million	29	71	100
2. 10 to < R50 million	39	61	100
3. 50 to < R100 million	63	38	100
4. 100 to < R500 million	53	48	100
5. R500 million or more	58	42	100
6. No revenue data	50	50	100

Table 16: Overview of survey response data by primary sector of the firm

Number of firms

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	13	60	73
2. Business services	20	19	39
3. Mining	2	4	6
4. Agriculture	0	9	9
5. Transport/communication	3	4	7
6. Other	0	2	2
Total	38	98	136

Percentage of firms

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	34.2	61.2	53.7
2. Business services	52.6	19.4	28.7
3. Mining	5.3	4.1	4.4
4. Agriculture	0.0	9.2	6.6
5. Transport/communication	7.9	4.1	5.1
6. Other	0.0	2.0	1.5
Total	100.0	100.0	100.0

Median age of firm in 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	21.0	20.5	21.0
2. Business services	16.5	15.0	16.0
3. Mining	13.0	44.0	16.5
4. Agriculture	-	21.0	21.0
5. Transport/communication	26.0	23.0	24.0
6. Other	-	17.0	17.0
Total	16.5	20.0	19.0

Median profit in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	1.4	14.6	14.4
2. Business services	3.6	0.5	2.8
3. Mining	351.0	8356.0	3750.0
4. Agriculture	-	13.3	13.3
5. Transport/communication	-	13.0	13.0
6. Other	-	4.3	4.3
Total	2.8	13.3	11.6

Median taxable income in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	10.7	2.9	2.9

2. Business services	5.8	0.5	2.9
3. Mining	1.0	-70.0	0.0
4. Agriculture	-	6.0	6.0
5. Transport/communication	-	12.5	12.5
6. Other	-	1.0	1.0
Total	4.8	3.7	3.7

Median turnover in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	170.0	86.2	100.0
2. Business services	27.8	23.1	25.5
3. Mining	854.0	31130.1	9477.1
4. Agriculture	-	39.8	39.8
5. Transport/communication	5.0	197.5	95.0
6. Other	-	464.3	464.3
Total	27.8	75.8	62.6

Median expenses in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	20.0	51.3	49.8
2. Business services	22.0	23.9	23.0
3. Mining	503.0	19633.5	2133.5
4. Agriculture	-	15.6	15.6
5. Transport/communication	-	82.0	82.0
6. Other	-	8.5	8.5
Total	21.0	49.9	36.2

Median labour remuneration in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	7.9	23.5	21.8
2. Business services	14.0	11.0	12.3
3. Mining	208.5	5915.0	1121.0
4. Agriculture	-	6.4	6.4
5. Transport/communication	-	54.0	54.0
6. Other	-	5.5	5.5
Total	13.3	21.3	16.7

Proportion of firms with more than 100 employees in 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.5	0.5	0.5
2. Business services	0.1	0.3	0.2
3. Mining	0.5	1.0	0.8
4. Agriculture	-	0.4	0.4
5. Transport/communication	0.0	0.5	0.3
6. Other	-	0.5	0.5

Total	0.3	0.4	0.4

Median R&D expenditure in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	1.4	5.3	4.2
2. Business services	2.1	4.0	2.6
3. Mining	76.3	44.5	44.5
4. Agriculture	-	1.2	1.2
5. Transport/communication	0.4	25.7	20.0
6. Other	-	2.3	2.3
Total	2.0	5.0	3.6

Median non-labour R&D expenditure in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.9	0.6
2. Business services	0.0	0.0	0.0
3. Mining	75.1	21.0	21.0
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	5.1	2.4
6. Other	-	0.3	0.3
Total	0.0	0.4	0.1

Median number of permanent R&D employees for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	4.0	7.0	6.5
2. Business services	4.0	7.0	5.0
3. Mining	2.5	47.0	7.5
4. Agriculture	-	5.5	5.5
5. Transport/communication	1.0	34.0	18.0
6. Other	-	6.5	6.5
Total	4.0	7.0	6.0

Average exports in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	8.6	6.8
2. Business services	0.8	0.0	0.0
3. Mining	0.0	1050.0	0.0
4. Agriculture	-	0.1	0.1
5. Transport/communication	0.0	14.8	6.0
6. Other	-	0.0	0.0
Total	0.0	0.9	0.0

Median percentage of R&D on basic research for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.0	0.0

2. Business services	0.0	0.0	0.0
3. Mining	2.5	0.0	0.0
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	5.5	1.0
6. Other	-	0.0	0.0
Total	0.0	0.0	0.0

Median percentage of R&D on applied research for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	2.5	0.0
2. Business services	0.0	0.0	0.0
3. Mining	5.0	17.5	12.5
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	15.0	0.0
6. Other	-	0.0	0.0
Total	0.0	0.0	0.0

Median percentage of R&D on design and developed for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	30.0	20.0
2. Business services	15.0	0.0	0.0
3. Mining	30.0	25.0	25.0
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	79.5	79.0
6. Other	-	20.0	20.0
Total	0.0	25.0	20.0

Median percentage of R&D on adaptation for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.0	0.0
2. Business services	0.0	0.0	0.0
3. Mining	12.5	17.5	17.5
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	5.0	0.0
6. Other	-	30.0	30.0
Total	0.0	0.0	0.0

Average number new/improved products over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	2.7	6.4	5.7
2. Business services	0.0	0.5	0.2
3. Mining	7.0	0.0	2.3
4. Agriculture	-	17.0	17.0
5. Transport/communication	0.0	2.5	1.4
6. Other	-	3.0	3.0

Total	1.3	5.7	4.5

Average number new/improved services over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	1.2	0.7	0.8
2. Business services	13.3	0.1	6.9
3. Mining	6.0	2.5	3.7
4. Agriculture	-	1.3	1.3
5. Transport/communication	0.0	2.3	1.3
6. Other	-	0.0	0.0
Total	7.8	0.8	2.7

Average number new/improved computer hardware over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.5	0.5	0.5
2. Business services	2.8	2.7	2.7
3. Mining	7.0	0.0	2.3
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	2.5	1.4
6. Other	-	0.5	0.5
Total	2.0	1.0	1.2

Average number new/improved computer software over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.1	0.1
2. Business services	0.3	0.1	0.2
3. Mining	5.0	0.0	1.7
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	0.0	0.0
6. Other	-	0.0	0.0
Total	0.4	0.1	0.2

Average number new/improved processes over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.1	0.7	0.5
2. Business services	1.1	0.1	0.6
3. Mining	5.0	0.3	1.8
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	2.0	1.1
6. Other	-	0.0	0.0
Total	0.9	0.5	0.6

Average number of patents registered over past five years in SA

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.5	1.1	1.0

2. Business services	0.1	0.4	0.3
3. Mining	0.0	1.3	0.8
4. Agriculture	-	15.1	15.1
5. Transport/communication	0.0	4.5	2.6
6. Other	-	0.5	0.5
Total	0.2	2.4	1.8

Average number of patents registered over past five years outside SA

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.6	2.4	2.1
2. Business services	0.1	0.5	0.3
3. Mining	0.0	4.8	3.2
4. Agriculture	-	0.0	0.0
5. Transport/communication	0.0	0.0	0.0
6. Other	-	0.0	0.0
Total	0.3	1.7	1.3

Proportion of firms that believe capital is a constraint to R&D

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.2	0.2
2. Business services	0.1	0.3	0.1
3. Mining	1.0	0.0	0.3
4. Agriculture	-	0.7	0.7
5. Transport/communication	-	0.0	0.0
6. Other	-	1.0	1.0
Total	0.1	0.2	0.2

Proportion of firms that believe skills are a constraint to R&D

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.3	0.4	0.4
2. Business services	0.4	0.3	0.4
3. Mining	0.0	0.3	0.2
4. Agriculture	-	0.5	0.5
5. Transport/communication	-	0.5	0.5
6. Other	-	1.0	1.0
Total	0.3	0.4	0.4

Table 17: Overview of sample used to estimate the impact of the incentive by primary sector of application

Number of firms

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	5	13	18
2. Business services	9	5	14
Total	14	18	32

Median age of firm in 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	8.0	15.0	14.0
2. Business services	15.0	13.0	13.5
Total	14.0	13.5	13.5

Percentage of firms

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	35.7	72.2	56.3
2. Business services	64.3	27.8	43.8
Total	100.0	100.0	100.0

Median age of firm in 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	8.0	15.0	14.0
2. Business services	15.0	13.0	13.5
Total	14.0	13.5	13.5

Median profit in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.3	2.0	1.6
2. Business services	3.6	11.1	4.7
Total	1.4	2.4	1.9

Median taxable income in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.7	0.0	0.0
2. Business services	4.8	1.0	2.9
Total	1.6	0.0	0.8

Median turnover in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	4.0	13.0	11.6
2. Business services	26.0	35.0	27.8
Total	22.5	30.0	25.0

Median expenses in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	7.9	11.0	9.7
2. Business services	26.0	23.9	25.0
Total	17.1	17.7	17.1

Median labour remuneration in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	3.8	5.5	4.7
2. Business services	14.0	5.8	12.3
Total	10.3	5.6	7.0

Proportion of firms with more than 100 employees in 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.2	0.2	0.2
2. Business services	0.1	0.0	0.1
Total	0.1	0.1	0.1

Median R&D expenditure in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	1.3	2.2	1.8
2. Business services	1.5	5.0	1.8
Total	1.4	3.1	1.8

Median non-labour R&D expenditure in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.6	0.8	0.7
2. Business services	0.0	0.5	0.0
Total	0.0	0.7	0.2

Median number of permanent R&D employees for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	4.0	5.0	4.5
2. Business services	3.0	3.0	3.0
Total	3.5	4.5	4.0

Average exports in R million for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.6	2.3	1.3
2. Business services	0.0	0.0	0.0
Total	0.3	0.1	0.1

Median proportion of R&D on basic research for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	2.0	5.0	3.5
2. Business services	0.0	0.0	0.0

Total	0.0	0.0	0.0

Median proportion of R&D on applied research for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	5.0	20.0	15.0
2. Business services	0.0	20.0	12.5
Total	4.5	20.0	12.5

Median proportion of R&D on design and developed for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	50.0	40.0	40.0
2. Business services	0.0	60.0	35.0
Total	25.0	45.0	40.0

Median proportion of R&D on adaptation for 2017

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	10.0	5.0	7.5
2. Business services	0.0	0.0	0.0
Total	0.0	3.0	0.5

Average number new/improved products over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	6.4	2.9	3.9
2. Business services	0.0	1.8	0.6
Total	2.3	2.6	2.5

Average number new/improved services over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	3.2	1.2	1.8
2. Business services	0.0	0.0	0.0
Total	1.1	0.9	1.0

Average number new/improved computer hardware over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	1.0	1.5	1.3
2. Business services	3.1	3.8	3.4
Total	2.4	2.1	2.2

Average number new/improved computer software over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.3	0.2
2. Business services	0.3	0.2	0.3
Total	0.2	0.3	0.3

Average number new/improved processes over past five years

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.7	0.5
2. Business services	1.3	0.2	0.9
Total	0.9	0.6	0.7

Average number of patents registered over past five years in SA

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.8	1.5	1.3
2. Business services	0.0	0.8	0.3
Total	0.3	1.3	0.8

Average number of patents registered over past five years outside SA

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.6	4.6	3.5
2. Business services	0.0	0.6	0.2
Total	0.2	3.5	2.1

Proportion of firms that believe capital is a constraint to R&D

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.0	0.1	0.1
2. Business services	0.1	0.2	0.2
Total	0.1	0.1	0.1

Proportion of firms that believe skills are a constraint to R&D

Primary sector of the application	1. No incentive	2. Incentive	Total
1. Manufacturing	0.4	0.4	0.4
2. Business services	0.6	0.6	0.6
Total	0.5	0.4	0.5

Appendix 4. Qualitative feedback from firms that participated in 2018 survey

(Should we report this verbatim given confidentiality or better to summarize?)

Self-reported application status	Feedback
Approved	Better communication, marketing from the Dept. Science and Tegnology, as well as improved tax benefits for Research Expenses. Communication from the Dept. Science and Tegnology was a bit slow and we had to follow up matters from our side to ensure that our applications were accepted. DST should assist entities in establishing valid R&D claims and assisting with applications. The process of determining whether these are valid &D claims are very technical, complex and time consuming.
	The application process and awaiting approval is prolonged, approval should be received timeously.
	Great initiative, well done!
	I seems to work efficiently and the response to applications has been good. It has been a big help is making it more viable to take on R&D projects.
	I think it is great that government is willing to support companies who develop new technology in this way. I would suggest that business incubator programmes be made aware of this programme and that there is a facilitator that could assist startups worth the application process as well as ongoing reporting. We have used one of the big tax companies who was very efficient and knowledgeable, but bitterly expensive compared to the value of our R&D budget. I would say as much as 10% went towards the administration costs. For small companies this would just not make sense. There could maybe be a different form of this programme for very small startups which could be capped to a maximum benefit. The process has to be facilitated by a knowledgeable tax practitioner which is very expensive, if we did not already had the capital to fund the application we would not have submitted our application. I cannot see how small startups will be able to to fund this, especially if there is a risk that the application may be turned down.
	I think the scheme is good and fair. No issues whatsoever but we are assisted by Catalyst. We could no doubt handle the task ourselves but I think smaller, younger businesses would be unable to perform the required administration and formulate the applications without assistance of a service provider like Catalyst.
	We would like to see overseas R&D expenses allowed to an extent. This is especially important where international product approval certification is required and some testing is required to be performed by the approval body (which is overseas).
	It might be good to include a learner ship or Internship program to be included for us in the R&D process. Currently we use Interns from SITA for our business processes but not for R&D which is something we would like to add. Experience was good, communications easy and the results were excellent.
	New to us so we need to work through the process of applying this incentive and fully understand the benefits vs work required for a successful application
	One application submitted to date, managed on our behalf by, was a slow process, turnaround time in process, including DTI input can improve,
	Please see comments above. It would be amazing to have flexible, strategic and meaningful support for our business as we are at the cutting edge of innovation globally. Policies are out of line with reality, legislation is complex, contradictory and restrictive. Extremely complicated application process, out of sync with needs of business. The forms don't align to our needs, and the process takes too long, is complicated with more reporting than actual investment in support of the actual business. Conditions are too restrictive, not flexible enough and there is no incentive or assistance

to actually protect the IP as it will be owned by the university and / or the government. At least we were able to pass through the money to.
Submission of documents at the beginning and end of the year is exhausting
The R&D tax incentive has been hugely successful to us as a company where the tax saving has funded new products which makes us market leaders in our field and generating valuable exports for RSA.
We have managed to employ more engineers in order to further technology R&D Experience has been good.
Applications sent in took a long while to approve.
The annual report provided for the status of R&D activities for 2017 was sent per registered letter during Feb 2018 as per the authorisation letter received from DTI and sent to the address provided on DTI website. The letter was returned unclaimed. Several emails were sent to DTI to enquire about this and request alternate methods to submit the annual report, all of which went unanswered.
The approval process takes long. It takes very long for us to receive approval. One can only claim once the approval has been received, and if that took too long, the company would submit the tax return without claiming those expenses. If it was subsequently approved, the company has to open the tax return and then struggle to get that claim. It makes it very difficult to make use of the extra 50% claim. If the approval is quicker, it will benefit companies more.

One can only claim from date that the approval was handed in - in our business that makes it difficult. Because we only know at a later stage whether this would fall under R&D. When we submit our forms then (which is also lengthy) most of the work has already been done and we can't benefit from the deduction. Our company has lost millions of deductions because of this. You should change the process to be able to claim for the date the project started that the company got approval for.
The process is difficult to complete in tandem with the development, i.e. it is a very lengthy proces that shifts focus from R&D to the applications rather than supporting the R&D more
The process of claiming through SARS has been difficult. We needed to hire PWC at great expense to put together the correct objection to get the deduction from SARS. Tax assistance, specifically for the R&D incentive should be made available - preferably through some online portal that would submit straight to SARS.
The process requires quite detailed information of each project, each employee that is directly linked's salary information etc.
The process to submit is complicated and we require external assistance to complete the relevant detail.
The process was efficient and effective
The website accessibility is a cause to concern. We usually struggle to access the site most of the times
We found our interactions with DST to be very efficient and professional once we had the correct contact person in place.
We have experienced the process to be efficient. Our tax consultants assisted us a lot in our applications and will be assisting us in completing our tax return.
We have not filed yet as our submission was only made early this year.
We haven't had any problems with claiming and reporting. This is because we have an audit firm that reviews our submissions in terms of the requirements.
We were pleasantly surprised with how easy the whole process is. Companies needs to be aware of this incentive, as we have traded for years not claiming anything simply because we were not aware of it. Also, too few people is clued up with this program, I had to contact several entities before someone could give me the correct information on how to proceed.

	application and approval - positive, although the process was quite drawn-out claiming - narrow interpretation from SARS reporting - positve services were outsources as the company is not familiar with the process. the strategy and initiatives are good in principal. the bureaucracy that gets created around it kills the initiative. this is because the government individuals working with it are not knowledgeable in the field, they create so many constraints to protect their uninformed position that the initiatives never get off the ground. approval was delayed, but otherwise it was a good experience. we would like to see larger percentages... effective incentive is only around 12 % of spend...
Partially approved	Can make the process of aprovement quicker Cane be extended and incentivised more Delays were experience initially (2013), but since then no issues have been experienced. Give an added incentive for R&D that leads to export sales via Licensees or directly. Overall a great program, that does incentivise research . Only criticism- Too bureaucratic and tedious. Several reports and surveys required such as this. Single annual report / survey would be better for all R&D. I think R&D businesses are crucial for the development of SA. Especially small businesses as they employee young people and have the ability to train these young people and mentor them. (As appose to big businesses where there is internships/learnership programs but it is run by HR and not by engineers who spend time with the young employees like in small businesses) There has been lots of focus from government to look at small businesses but I believe there is more that can be done. There are allot of policies in place at the moment but we are not all aware of them. I suggest government officials with all the knowledge of how small businesses can be assisted need to visit these businesses, understand them and offer advise and support. Businesses can request this support online and it should be free of charge. This will help the growth of our economy and uplift communities. Apart from the lack of communication and long application process (1+ years), it was a nice experience. The staff were very friendly and I always got feedback when I phoned in. I suggest that the process gets more streamlined to improve on turn around times. I believe that a turn around time of 3 months is fair. Anything longer makes it more difficult for a company since you don't know if you will get the financial assistance or not, it is difficult to do tax planning, BBBEE planning and cash flow planning. If a SME slip on tax planning, cash flow planning or BBBEE planning, it could mean that they need to close their doors. I think the new online system will be an improvement. We could not claim all the R&D tax incentives by the time that our financial statements were completed as we have not received confirmation from DST I was surprised by the focus on Intellectual Property and patenting - it is not at all the case that R&D always leads to IP We were only accepted for the R&D tax incentive in the current financial year , so we have not made any claims or done any reporting as yet Involvement in reporting for the tax incentive It is a great mechanism for stimulating much needed research and development in the South African Agricultural industry. It is not a difficult process to follow. It would be excellent if the R&D incentives were judged in a slightly more informed manner. We only submit projects that we're certain will meet all the requirements, yet we have been unsuccessful over the past 2 years. It is an excellent and honest scheme. Unfortunately, many companies take full advantage of claiming for R&D where R&D isn't done. In our case, being a technology developer, almost 100% of our business involves a very high degree of R&D. We would welcome a visit from the DST to witness and audit what we are doing in this respect.

Lengthy Response time for Application and submission processes, however good support system Make the process easier
Overall the experience this far has been good. Progress seem to have been made in the backlog of applications. Communications have been good. Is however disappointed that some applications has been denied. Feel that in some instances the requirements to show that your project is a totally new concept is to strict.
Red tape is making it impossible for small R&D companies to thrive! The time from submitting the application until receiving authorization, is far too long.
See 12.2 - The 2017 tax return due date is 31 Dec 2017, we've not finalised the tax return as yet.

We need improved administration and collaboration as the current incentive do make us competitive, the time when barriers to enter the technology market was high is gone, everyone can enter, we need to be competitive on a global scale. The R&D incentive makes us more competitive!!
The DST staff is professional and helpful.
The forms to be submitted is not so consumer friendly since there is lots of repetitions of the questions. It is just asked in another way.
The R&D tax incentive programme is a brilliant initiative. Many developed countries have similar programmes as it attracts investment and skilled people, who invest money and human capital, create employment and tax revenue for the country.
All we need to is make the approval process work in a reasonable time period. The process is tedious. The approval process goes on for years without any feedback.
The pre-approval process is tedious. Due to delay is approvals past tax returns have to be reopened which is an administrative burden.
The processing of applications for R&D tax incentive program needs to be processed within a reasonable amount of time (1.5 years is not reasonable). This will incentivize companies to improve reporting on R&D activities. It would also make the use of the R&D tax incentive program more attractive and more firms would use it.
Also make the reporting process more streamlined Positive - certainly encourages spending on R&D
There has to be closer "communication" between DST and SARS regarding the deductibility of R&D expenditure. Companies need to be advised upfront and at time of the approval of the projects how much they may deduct (Rand value). This has to be fixed up front so that there are no misinterpretations.

The whole process has to speed up so that one does not have to re-open IT14's in order to correct your taxable income It takes too long for the incentive to be approved. 2017 is a good example of the latter. There also seems to be no cohesion between the DST and SARS as the one gives permission to incur the expenditure but the other one disallow the deduction. By the time the latter disallows the deduction, the cost has been incurred already. Many companies in the Industry have been wondering for a few years now if it the whole process is worth it.
Time from completing application to actually receiving the approval took a while, they need to look at possibly speeding up the process.
Timelines for approval/disapproval is very high
Turnaround times for approval of projects are too long.
Very few projects were approved by the DST, and accordingly Transnet has not been in a position to claim a significant amount of the additional 50% R and D tax incentive allowance. In respect of the progress R and D reporting, we have been submitting progress reports to the DST but we have not received any feedback in this regard. We would also appreciate it if the DST could provide the reason/s for rejecting projects not approved.

	Very good. We would like to suggest that communication between the Application assessors , adjudicators and related processes be more accessible to companies. Currently we submit the application and until we hear whether it ahs been approved or not, we don't know anything. Even after submitting motivation for initially declined projects. The website that was developed shows great potential. We would also like to suggest better interaction between SARS and the DST regarding correction or adjustments of previously finalized tax returns, due to old projects being approved after the fact and we can now claim the Tax deduction. Perhaps a specific process developed in SARS for this specific correction or adjustment, that it is not seen together with all other corrections or adjustments. But can be expedited and handled more swiftly and tailor-made to why the adjustment is being requested in the first place We believe it's a valuable service, simple to process and we really appreciate it. We have found the incentive system to work well, and hope that the new online portal will make reporting more efficient. It looks like only newly applied projects appear on the online portal. It would assist greatly if previously approved projects could be moved to the online portal for reporting. We submitted proposals and did receive funding for one of the projects. The only concern was the feedback time. We were notified more than 24 month after submission. This makes planning difficult for us. Seen that we are a young R&D department and planning is not yet for 5 year in advance. We were under the impression from our auditors that we could no longer claim this
Not approved	1) Administration requirements in order to receive funding are a burden. 2) The definition of activities that comply with the requirements is too narrow. There are probably benefits that could accrue to the country if funding was available for R&D initiatives that are not innovative and unique. Some R&D initiatives could just make things better. Present policies seem to be too restrictive. Does not assist high tech companies enough to create RSA IP that can be showcased to the world and help with the training of our own people in high tech fields of engineering. Previously huge government spending on technology development in the armament industry has basically dried up leaving a terrible gap for general high tech training and development of our engineers and scientists in all disciplines to the detriment of the RSA as a whole. We are as a country moving backwards in the field of technology development compared to the past where the RSA was in many spheres at the fore-front of technical innovation. To my mind the SKA is presently the only project in the RSA that is of any value in this regard, but is very limited for overall high technology advancement of our people. The process is very slow and applications are not reviewed and responded to in due time. We had to re-open submitted tax returns and make changes after our application was declined , resulting in tax penalties. The process was amazingly opaque and 0 useful feedback was given. At the germination stage of products or R&D, researchers and entrepreneurs are guarding their time, focusing on what matters most. Dedicating time to an opaque process that appears to not work is a waste that nobody in that position can afford. i have tutored multiple young entrepreneurs and advised them all to not consider the program since it appears to be so poorly handled. We are a small company, but we compete with the best in the world with very innovative products, this the DST failed to recognized and dismissed our application. We therefore assumed that the DST is not committed to help our kind of companies and therefore stopped applying.

With our last application it became very clear that the burden of the administration to comply with the R&D tax incentive rules far outweighs the tax benefits.

Yes indeed, it is VITAL the the person/s evaluating the applications, at least call and or interview the applicants, as we found that they do not have a clue about the technical ins and outs of the R&D undertaken and hence decline such applications..

South Africa is loaded with opportunity for entrepreneurs. We have bright minds and because of challenges we are forced to apply our minds and come up with creative ideas to solve real solutions. Technology is driving the world and South African businesses should be supported to enable them to develop unique solutions.

Streamlining of the R&D tax incentive application and progress reporting processes.

Import restrictions of controlled items and high customs tariffs on required goods.

Maintaining capabilities of Government owned test facilities, such as

Supporting infrastructure establishment at small companies to increase available subcontractors.

Availability of bursaries for engineers and quality control specialists, as well as internships.

This company has applied every year as required in terms of the applicable legislation. The only year for which a replied was received was 2017. The reply took 12 months to be prepared and issued by DST.GOV. This process needs to be fast and efficient to make the country a successful hub for this kind technological innovation.

We feel that those companies doing R&D projects in the development of software are not fully understood by the programme.

With no local economy including government infrastructure projects, export is the only hope to remain alive and employ people. This means export assistance is vital, as well as good governance in terms of infrastructure, access to capital, and fair tax laws.