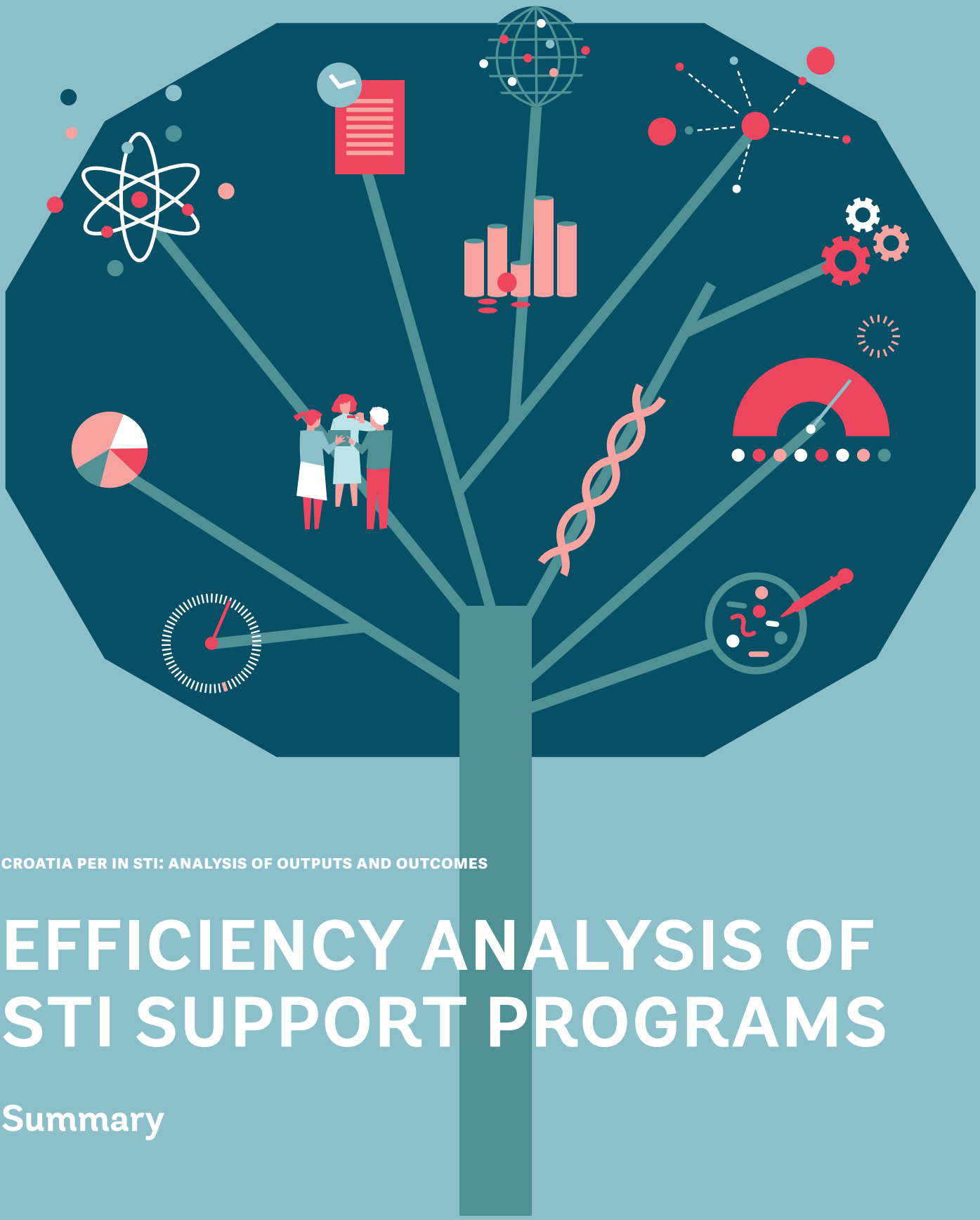

CROATIA PER IN STI: ANALYSIS OF OUTPUTS AND OUTCOMES

EFFICIENCY ANALYSIS OF STI SUPPORT PROGRAMS

Summary

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REPUBLIKA HRVATSKA
Ministarstvo znanosti i obrazovanja

REPUBLIKA HRVATSKA
Ministarstvo regionalnoga razvoja i fondova Europske unije

EUROPSKI STRUKTURNI I INVESTICIJSKI FONDOVI

Operativni program KONKURENTNOST I KOHEZIJA

Europska unija
Zajedno do fondova EU

This brief presents a summary of findings and recommendations resulting from efficiency analysis of seven STI support programs, quantifying the costs of running the program, the results achieved by beneficiaries, and their satisfaction with various aspects of the program. The analysis covers three programs led by the Ministry of Science and Education (MSE), two programs led by the Ministry of Economy and Sustainable Development (MESD) and two programs led by the Croatian Science Foundation (HRZZ). The analysis is based on cost data collected from institutions as well as two surveys conducted among program beneficiaries (one for researchers and one for firms). The analysis for each program covers four areas: efficiency in the use of inputs, efficiency in the generation of outputs, progress on outcomes, and perceived quality. For more details on the approach, results, and recommendations please refer to the report "Analysis of Outputs and Outcomes" (World Bank 2021).

EFFICIENCY IN THE USE OF INPUTS

Administrative and operating costs make up a low share of costs covered by the program

The analysis of administrative and operating costs, although limited,[1] reveals that in programs that target researchers,[2] administrative and operating costs make up between 5 and 10 percent of total program costs. Administrative and operating costs were driven by personnel costs, followed by external experts hired to evaluate project proposals or monitor implementation progress.

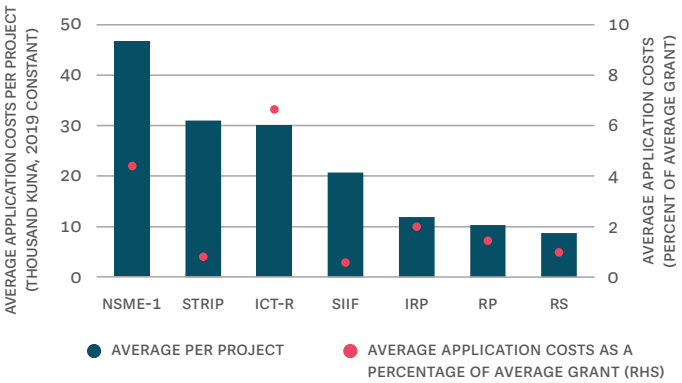
Application costs are high for programs targeting firms, while applications to programs targeting researchers take more time to prepare

Average application costs for firms amounted up to seven percent of the average grant amount (Figure 1).[3] High application costs represent a significant barrier to program participation and may be related to the use of consultants and experts to help prepare the application. Over 80 percent of respondents used additional help of experts and consultants, which could be an indication of complexity of application process. Researchers invested more time in preparing applications compared to firms. Project leaders of researchers' programs reported taking around four weeks on average for project preparation, compared to less than three weeks for firms' programs. Overall, the time needed to prepare the application is positively associated with application costs, and this correlation is significant at the 95 percent confidence level.

Researchers receive more funding relative to the investment they make

On average, firms received two to three times the amount of funding that they invested in participating in the program, a much lower multiplier compared to that of researchers (5 to 16 times). While to some extent this reflects the difference in state aid intensity between private and public sector, as well as between research and commercialization, policymakers should at least aim to reduce application costs for firms, which are comparatively quite high.

Figure 1 Application costs are generally higher for programs targeting firms



Source: Beneficiary surveys.

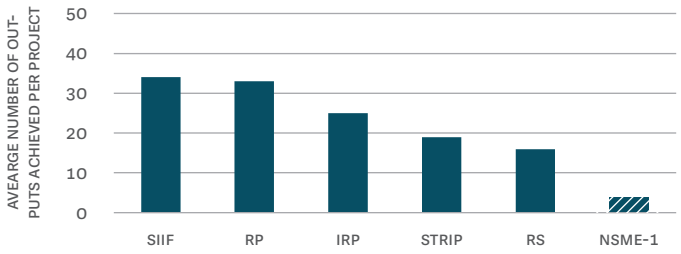
1 Administrative and operating costs were only available for programs targeting researchers.
2 Analyzed programs targeting researchers include: Science and Innovation Investment Fund (SIIF), Strengthening capacities for Research, Development and Innovation (STRIP), Research Scholarships for Professional Development of Young Researchers (RS), Research Projects (RP), and Installation Research Projects (IRP).
3 Analyzed programs targeting firms include Improving Competitiveness and Efficiency of SMEs through ICT (ICT-R) and Innovations in Newly Established SMEs - Phase 1 (NSME-1).

EFFICIENCY IN THE GENERATION OF OUTPUTS

Programs targeting researchers generated outputs related to capacity building and collaborative projects

Among programs targeting researchers, SIIF and RP programs generated the greatest number of outputs per project (Figure 2), while the RP and IRP program had the highest number of outputs per program costs. According to the Theory of Change developed for these programs, intended outputs included capacity building outputs (training events and workshops, seminars, and conferences) and collaborative projects.

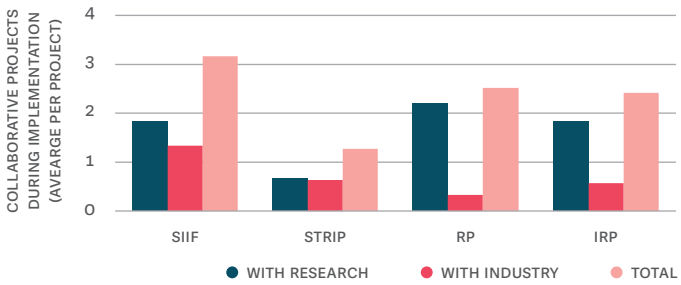
Figure 2 Respondents of SIIF and RP programs had the highest number of outputs per project



Source: Beneficiary surveys. Note: Bars filled with a diagonal pattern denote programs targeting firms.

In general, collaborative projects with industry and international collaborative projects lag those with other researchers and domestic projects (Figure 3). Among researcher programs, RP resulted in more collaborative projects within the research sector, but SIIF had the most projects with industry. Longer tenures of project leaders in the research institution linked to the project are associated with fewer collaborative projects with other researchers after project completion, and this correlation is significant at the 95 percent confidence level.

Figure 3 SIIF, RP and IRP had the highest average number of collaborative projects per grant

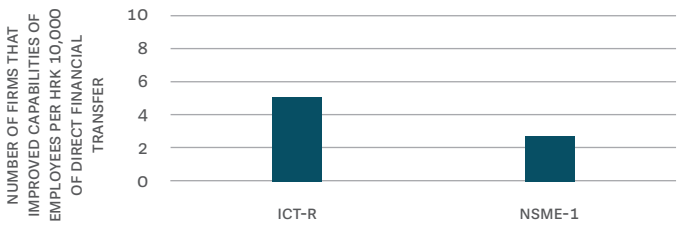


Source: Beneficiary surveys.

Programs targeting firms also generated outputs related to capacity building

Among programs targeting firms, the ICT-R program had more capacity building outputs per cost than NSME-1, but NSME-1 respondents also reported greater variety of other outputs. Under the ICT-R program, 5 firms improved capabilities of employees for each HRK 10,000 of program cost (Figure 4). In the NSME-1 program this was not an intended output. However, the NSME-1 program also yielded a variety of other outputs, including market-oriented research, IPR registration (patents, copyrights, trademarks, and industrial designs), and additional full-time and part time employees.

Figure 4 The ICT-R program produced more capacity building outputs per unit of cost



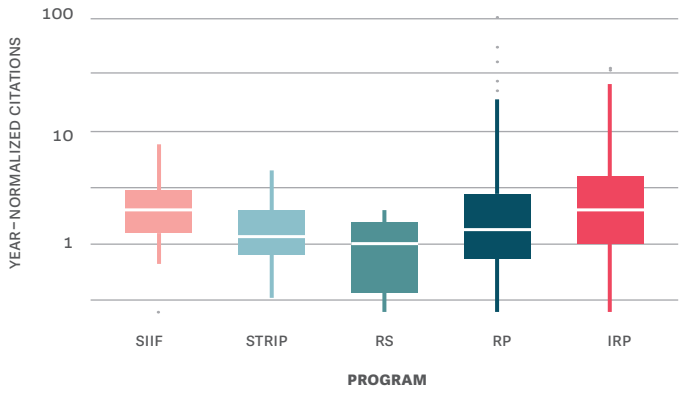
Source: Beneficiary surveys.

EFFICIENCY IN THE GENERATION OF OUTCOMES

Scientific publications are the most common outcome of researchers' programs, while technology transfer and intellectual property protection outcomes have been less fruitful

According to the beneficiary survey, most respondents produced a large volume of scientific publications as a result of their projects, however only around a fifth of them are indexed in citation databases. Of the five analyzed programs targeting researchers, SIIF, RP and IRP on average produced the highest-impact publications. IRP and SIIF had the highest median citations (controlling for the age of the publication), equivalent to 2 citations per year (Figure 5). Publications associated with projects financed through the RP program had somewhat lower median citations than IRP and SIIF, but this program also had more positive outliers. The most cited publication was funded by the RP program and had a total of 412 citations. In all programs, around 60 percent of publications take about one year to get cited, though in the RP and IRP programs about 10 percent of publications remain uncited after two years, and roughly 5 percent are uncited after four years.

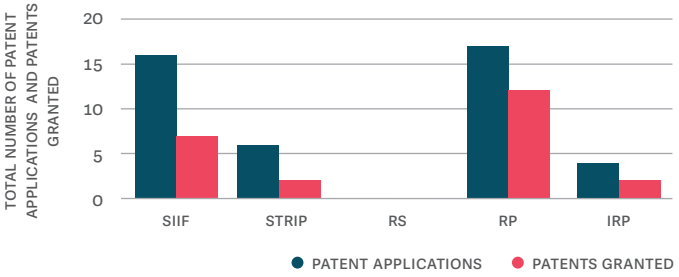
Figure 5 SIIF, RP and IRP on average produced the most cited publications



Source: Beneficiary surveys, SCOPUS, and staff elaboration.

Results related to intellectual property were limited in programs for which they were expected. For example, SIIF respondents submitted 1.3 patent applications per project on average, and 0.6 patents were granted per project on average, for a total of 16 patent applications and 7 granted (Figure 6). It appears that survey respondents were less committed to achieving outcomes related to intellectual property, because few of them invested in these activities and those that did, invested a relatively small share of the project budget. Interestingly, having collaborative projects with researchers or firms during implementation is associated with a higher number of patents filed and this correlation is significant at the 95 percent confidence level.

Figure 6 RP and SIIF had the highest number of patent applications and patents granted

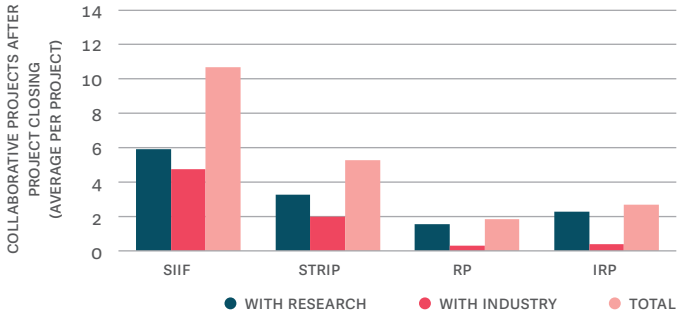


Source: Beneficiary surveys.

Few science-industry collaborations were reported after project completion

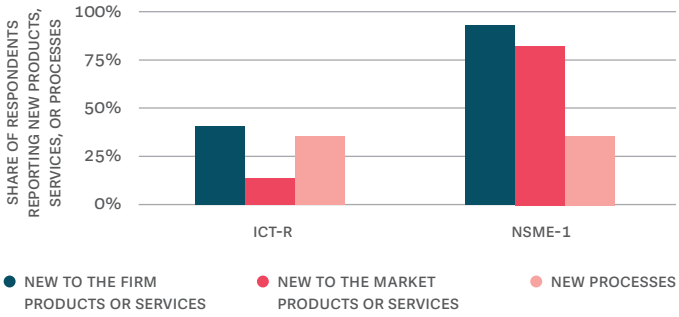
Although some programs managed to initiate collaborations between researchers and industry, prioritizing or incentivizing industry-science linkages is lacking especially in programs that reach a large number of researchers (Figure 7). Further, domestic partners are most prevalent among respondents, both for research and industry partners. As international collaborations are important for the quality of scientific outputs these types of collaboration should be more encouraged.

Figure 7 SIIF resulted in the most collaborative projects after project completion



Source: Beneficiary surveys.

Figure 9 ...but a higher share of respondents achieved those outcomes in the NSME-1 program

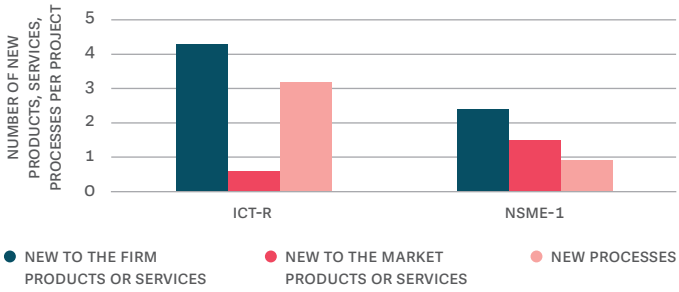


Source: Beneficiary surveys.

New-to-the-firm products, processes, or services were achieved more frequently than new-to-the market outcomes

On average, respondents from the ICT-R program developed four products or services per project that were new to the firm, two times the number developed by respondents of the NSME-1 program (Figure 8). But when it comes to the number of products or services that were new to the market, respondents from the NSME-1 program developed two times as many per project as respondents from the ICT-R program. In NSME-1, the results were also spread out among a greater share of respondents (Figure 9). This reflects the differences in the design of the two programs, the latter being more focused on commercializing new products or services, while the former supported technology upgrades. In addition, respondents of the STRIP program (45 percent of them) reported a total of seven new products, processes or services.

Figure 8 The ICT-R program resulted in more new products, processes, or services per project...

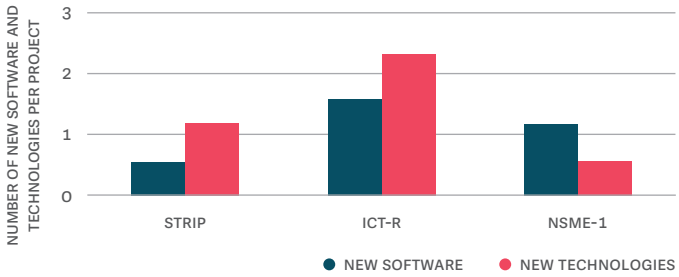


Source: Beneficiary surveys.

Respondents also developed new software and technologies

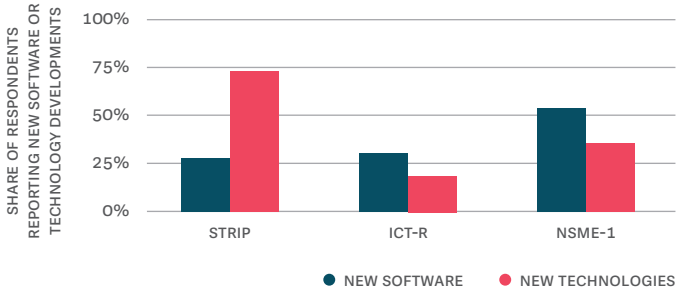
Respondents recorded achievements in terms of development of new software and technologies (Figure 10). The ICT-R program developed the largest number of software and technologies per project, but these were achieved by a relatively smaller number of respondents (Figure 11).

Figure 10 ICT-R respondents developed the highest number of new software and new technologies



Source: Beneficiary surveys.

Figure 11 A higher share of respondents developed a new technology in the STRIP program than in the ICT-R and NSME-1 programs



Source: Beneficiary surveys.

PERCEIVED PROGRAM QUALITY

At application stage respondents found program flexibility and information requirements to be least satisfactory

Survey respondents assessed about 20 aspects of the program at application stage. Respondents were most satisfied with the clarity of program objectives, but they found program flexibility and information requirements to be the least satisfactory. Program information was easily accessible to most respondents, which confirms the transparency of program information.

Respondents were also less satisfied with the time needed to complete the selection process, and indeed, for one of the programs, two years passed between the publication of the call and contract signing. Such long delays disrupt business planning and are unacceptable for science, technology, and innovation support programs, given the fast pace of technological and scientific advancements.

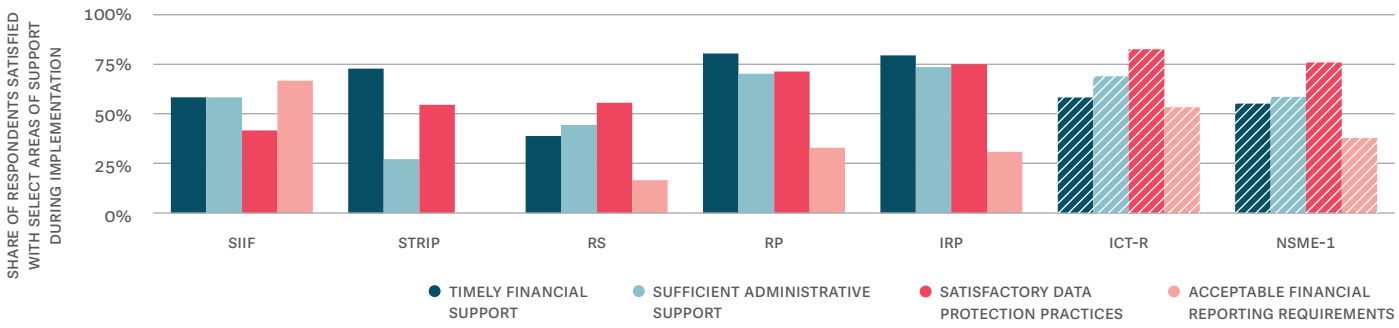
During implementation, respondents were least satisfied with financial reporting requirements

Respondents had different levels of satisfaction with various aspects of program implementation, with the exception of financial reporting requirements, which were found to be burdensome across all programs (Figure 12). Burdensome reporting requirements reduce the attractiveness of public support programs and may deter potential beneficiaries from participating.

Availability of human resources and financial resources were indicated as top success factors

When asked to select and rank up to three most important factors that contributed to the achievement of project results, most respondents indicated financial and human resources. Overall, respondents in all programs evaluated their project outcomes as matching their expectations. Compared to firms' programs, researchers' programs had a higher share of respondents indicating project outcomes exceeded their expectations.

Figure 12 During implementation, respondents were least satisfied with financial reporting requirements



Source: Beneficiary surveys. Note: Bars filled with a diagonal pattern denote programs targeting firms.

RECOMMENDED ACTIONS: ADDRESSING GAPS IN M&E PRACTICES

Conduct regular efficiency analyses

Regular efficiency analyses (ideally annual) should be conducted related to the use of inputs and generation of outputs and outcomes in order to make evidence-based decisions and adjustments.

Systematically generate and track program-level cost data

Program-level cost data should be generated and tracked, including administrative and operating costs to enable a more accurate assessment of the efficiency of programs. The cost template used for this analysis can be a starting point towards setting up such a reporting system.

Define benchmarks and targets for outputs and outcomes

Intended outputs and outcomes should be carefully defined, based on an explicit theory of change for the program. The Analysis of Theory of Change and Results Framework (World Bank 2020) provides a starting point for this, but adjustments may be needed as programs are further refined.

Conduct beneficiary surveys on a regular basis

Beneficiary surveys should be part of the monitoring and evaluation strategy of every program where beneficiaries can anonymously express their views.

Improve quality of data on outcomes

The quality of the data used to measure the efficiency in the generation of outcomes should be improved by conducting more impact evaluations. This would enable a more rigorous assessment of the generation of outcomes, as an impact evaluation would provide evidence on whether outcomes were achieved because of the program or not.

RECOMMENDED ACTIONS: IMPROVING THE EFFICIENCY OF SUPPORT PROGRAMS

Channel funds towards more influential research

Programs that target researchers should track the quality of scientific papers produced as a result of the project. This information could then be aggregated and used as an input to make informed decisions on, for example, allocation of funds among scientific fields.

Incentivize international collaborations

In most programs, international collaborations lagged behind domestic collaborations. More international collaborations should be encouraged, either through existing or new interventions.

Encourage science-industry linkages

Collaboration of researchers with industry should be strengthened by scaling up or adapting and introduce new support.

Focus on supporting technology transfer and research commercialization

IPR protection, technology transfer, and research commercialization should be stimulated further, including by increasing the role of the private sector, and creating a better incentive structure for researchers and their home institutions to engage in commercialization efforts.

Reduce application costs of programs targeting firms

Application information requested by beneficiaries should be simplified along with simplification of the selection criteria and increased flexibility in the selection processes. A more hands-on approach to workshops and program dissemination events may also help applicants deal with complex issues such as state aid calculation.

Introduce more flexibility in the application process

The project proposal review process should allow minor modifications in project applications, based on the feedback provided by selection experts. This would help increase the quality of projects, build up the capacity of applicants, and anticipate possible implementation issues.

Reduce reporting burdens on beneficiaries during implementation

Reporting requirements can be streamlined by reducing the number of documents needed, or using available data through other public sources.

Provide better administrative support

Existing administrative services to beneficiaries should be reevaluated, alongside strengthening the human resource base in institutions participating in STI financing.

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