



SCIENCE ENGAGEMENT MONITORING AND EVALUATION IMPACT INDICATOR FRAMEWORK

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Department of Science and Innovation (2021). *Science Engagement Monitoring and Evaluation Impact Indicator Framework*. South African Department of Science and Innovation. Pretoria.



BACKGROUND TO THE DEVELOPMENT OF THE FRAMEWORK ►

The Department of Science and Innovation (DSI) is the policy custodian of the country's science engagement (SE) programme, which seeks to promote a society that is knowledgeable about science, able to form independent opinions about science issues, and scientifically literate.

The DSI derives its SE mandate from the 1996 White Paper on Science and Technology, which directed the then-Department of Arts, Culture, Science and Technology to institute and deliver a science and technology public awareness programme in collaboration with stakeholders such as professional associations, academies of science, science museums and libraries, media, educational institutions, science councils and private business. Building on this mandate, the 2019 White Paper on Science, Technology and Innovation (STI) outlines a number of policy intents aimed at consolidating and deepening the SE programme that started in 1996.

The implementation of the SE programme is guided by the Science Engagement Strategy (2015), which seeks to build the envisioned society by pursuing the following four strategic aims:

Strategic aim 1: To popularise science as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers.

Strategic aim 2: To develop a critical public that actively engages with and participates in the national science and technology discourse to the benefit of society.

Strategic aim 3: To promote science communication that enhances SE in South Africa.

Strategic aim 4: To profile South African science and scientific achievements domestically and internationally, demonstrating their contribution to national development and global science and thereby enhancing their public standing.

The Government mandates the monitoring and evaluation of the performance of all publicly funded programmes to establish their impact on the lives of South African citizens. Guided by the National Evaluation Policy Framework (2011) of the Department of Planning, Monitoring and Evaluation (DPME) and the Framework for Managing Programme



Performance Information (2007) of the National Treasury, the DSI developed and adopted the SE Monitoring and Evaluation Framework (2019).

The SE Monitoring and Evaluation Framework (MEF) contains 66 indicators across five performance information concepts, namely, input, activity, output, outcome and impact. Not all of these indicators are tracked to establish the impact of the SE programme. Some are tracked to establish changing patterns and trends in the programme, while others guide continuous programme data collection and associated analytics.

The 2019 White Paper on STI foregrounded the need for a dedicated national public relationship with science survey as a system-wide measure of the success of the overall SE programme in South Africa. As part of this ongoing programme, the first South African Public Relationship with Science Survey (SAPRS Survey) will be conducted in the 2023/24 financial year to establish the unique fingerprint of the South African public's relationship with science. The Human Sciences Research Council (HSRC), referencing the South African Social Attitudes Survey (SASAS), will measure the distance South Africa has travelled on its journey towards a society that is knowledgeable about science, able to form independent opinions about science issues, and scientifically literate.

The SAPRS Survey will be conducted every five years, as directed by the MEF. Prior to each subsequent SAPRS Survey, the SE Monitoring and Evaluation Impact Indicator Framework will be reviewed in light of lessons learned from the preceding survey and other relevant considerations.

The impact indicators in the MEF highlight impact issues of interest in the DSI-led SE programme, and are enough to guide the planning of impact evaluations. To this end, the Science Engagement Monitoring and Evaluation Impact Indicator Framework kickstarts the planning and design process by methodically preparing a set of impact indicators

to measure the system-wide changes brought about by the SE programme among South Africans. Taking into consideration the foundational dimensions of the complex public relationship with science, the Framework identifies the following five *impact themes* that will be the focus of the SAPRS Survey:

Impact theme 1: Citizens' attitudes to and perceptions of science.

Impact theme 2: Citizens' confidence in science and science institutions.

Impact theme 3: Citizens' scientific literacy.

Impact theme 4: Citizens' knowledge of general and specific science areas.

Impact theme 5: Citizens' SE behaviour.

Each impact theme will be supported by *impact measures* that will inform data collection, organisation and reporting.

The Framework is designed to incorporate primary and secondary data from the SAPRS Survey and the Science Engagement Information Management System (SEIMS) in operationalising the aims and purpose of this system-wide national monitoring function. The SEIMS, as the primary repository and reporting mechanism of the SE programme, will serve as a source of secondary data that is continuously collected on projects implementing and complementing the SE programme, and will be organised according to the non-impact performance information concepts of the MEF's logical framework.

The Framework also includes *substantive non-impact measures*. Substantive non-impact measures represent visible signs in society that would ordinarily be expected to accompany certain changes in the impact measures, as reflected by the survey results. For example, positive attitudes of citizens towards science would ordinarily be accompanied by behaviours such as learner take-up of the gateway subjects of Mathematics and the Physical Sciences.



STAKEHOLDER ENGAGEMENT IN DEVELOPING THE FRAMEWORK ▶

The DSI and the HSRC held joint engagements with the South African Agency for Science and Technology Advancement (SAASTA) before producing a draft Science Engagement Monitoring and Evaluation Impact Indicator Framework in October 2019.

In September 2020, the DSI and the HSRC jointly hosted a Science Engagement Stakeholder Forum with attendees from public sector entities, higher education institutions, national and provincial government departments, and relevant non-governmental organisations (NGOs) to engage on the draft Framework.

Stakeholder feedback received during the forum was reviewed by the DSI and the HSRC and used to refine the draft Framework, after which the Framework was finalised.

Table 1: Science Engagement Monitoring and Evaluation Impact Indicator Framework

IMPACT THEME	IMPACT MEASURE	SUBSTANTIVE NON-IMPACT MEASURE ¹	DATA SOURCE
1. Citizens' attitudes to and perceptions of science	1.1 Attitudes of promise toward science		SAPRS Survey
	1.2 Attitudes of reservation toward science		
	1.3 Perceptions of the value of science in daily life		
	1.4 Public support of science		
	1.5 Attitudes to the Government's science investments over the past 5 years		
	1.6 Attitudes to the Government's science investment priorities for the next 5 years		
	1.7 Personal interest in Science and Technology (S&T) engagement		

¹ Substantive non-impact measures are assessment measures selected from the MEF that are used to monitor changes across system-wide science engagement.

IMPACT THEME	IMPACT MEASURE	SUBSTANTIVE NON-IMPACT MEASURE ¹	DATA SOURCE	
		A1 Research and Development (R&D) expenditure as a % of Gross Domestic Product (GDP)	Statistics South Africa (Stats SA)/R&D Survey	
		A2 Participation in Science, Technology, Engineering and Mathematics (STEM) subjects in Grade 12	DBE	
		A3 Expenditure on SE programmes as a % of total S&T expenditure	DSI/SAASTA/SEIMS	
		A4 Content of SE programmes and science promotion activities	SAASTA reports	
		A5 Attendance at SE activities	SAASTA/SEIMS	
2. Citizens' confidence in science and science institutions	2.1 Trust in science		SAPRS Survey	
	2.2 Trust in mainstream media science reporting			
	2.3 Trust in science institutions			
	2.4 Perceptions of transformation at science institutions			
	2.5 Trust in the Government's evidence-based approach to decision making			
			A6 Policy briefs and evidence-based recommendations from the DSI (and reporting institutions)	DSI/SEIMS
			A7 Presence of scientists on government advisory boards	Micro-survey of government departments
			A8 Citizen-centred dialogues	SAASTA/SEIMS
			A9 S&T public hearings	SAASTA/DSI/SEIMS
			A10 Policy instruments for transformation	Government policy documents
			A11 Demographics of STEM personnel in science institutions	University data from Department of Higher Education And Training (DHET)/ Council on Higher Education (CHE); DSI
			A12 Value of government financial contributions (e.g. DSI grants, scholarships, research grants) to historically disadvantaged STEM staff and institutions	DSI/ National Research Foundation (NRF)

IMPACT THEME	IMPACT MEASURE	SUBSTANTIVE NON-IMPACT MEASURE ¹	DATA SOURCE
3. Citizens' scientific literacy	3.1 Interest in selected scientific domains		SAPRS Survey
	3.2 Informedness regarding selected scientific domains		
	3.3 Interest in new scientific discoveries		
	3.4 Recognition of different forms of knowledge (e.g. indigenous and Western forms of knowledge)		
	3.5 Sources of scientific information		
		A13 Strategic interventions to protect and advance indigenous knowledge systems	DSI/SEIMS/govt policy documents
	A14 Coverage of science topics in identified media sources	Media analysis	
	A15 Public engagement on science topics on social media	Analysis of social media	
4. Citizens' knowledge of general and specific science areas	4.1 Awareness of South African scientific and technological discoveries		SAPRS Survey
	4.2 Awareness of and informedness regarding contemporary natural phenomena		
	4.3 Performance on a science knowledge index		
	4.4 Aspirations of youth (up to 35 years) to pursue STEM studies and careers		
	4.5 Awareness and informedness regarding public science investments		
		A16 Success in STEM subjects at Grade 10 and 12 level	Department of Basic Education (DBE) Education Management Information Systems (EMIS) and examinations data
		A17 South Africa's performance in the Trends in International Mathematics and Science Study (TIMSS) and % of learners achieving above the minimum competence level	TIMSS

IMPACT THEME	IMPACT MEASURE	SUBSTANTIVE NON-IMPACT MEASURE ¹	DATA SOURCE
		A18 Learners who participate in DSI school-based SE programmes and subsequently enrol for STEM subjects at Higher Education (HE) or TVET institutions	HEMIS
		A19 Participation in and completion of STEM subjects at HE and TVET level	HEMIS/DHET education statistics
		A20 Schools participating in extra-curricular Science, Technology, Engineering, Mathematics, and Innovation (STEMI) activities	DSI/SAASTA
5. Citizens' SE behaviour	5.1 Attendance at, or involvement in, public engagement activities		SAPRS Survey
	5.2 Adoption of technologies in personal, work and civic spaces		
	5.3 Individual behaviour and motivation to contribute to positive societal change		
	5.4 Behaviours related to STEM information sharing		
		A21 Deployment in schools of technologies supporting STEM learning and teaching	DBE (EMIS) DBE (Data Driven Districts Dashboard)
		A22 Major behaviour-changing campaigns related to STEM led by various government departments over a specified period	Micro survey targeting government departments
		A23 Behavioural incentives introduced to address STEM issues (such as health, climate change, energy, pollution)	Micro survey targeting government departments

Table 2a: Details of the Framework – Impact Measures

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
1. Citizens' attitudes to and perceptions of science	1.1 Attitudes of promise toward science	Measurement of attitudes of promise towards science (recognition of the potential benefits of science) over time	Composite measure of 7 items. 4 items measure scientific promise. Demographic disaggregation is possible.	Historic: SASAS (HSRC) First Measure: SAPRS 2023, then every 5 years
	1.2 Attitudes of reservation toward science	Measurement of reservations (concerns, fears) about science over time	Composite measure of 7 items. 3 items measure scientific reservation. Demographic disaggregation is possible.	Historic: SASAS (HSRC) First Measure: SAPRS 2023, then every 5 years
	1.3 Perceptions of the value of science in daily life	Measurement of the proportion of the public attributing value to science in daily life. The indicator measures learning, awareness and understanding of the contribution and context of science in daily life. Items will cover aspects relating to the multidimensional nature of life, including social, work and civic life.	Composite measure covering 3 aspects of daily life: social, work and civic. The indicator will be based on 6 items. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	1.4 Public support of science	Measurement of the proportion of the public that is supportive of investment in STI activities within selected disciplines (government or private investment)	Attitudinal measure of public support for continued investment in selected areas of STI activity (green R&D, Information and Communications Technology or ICT, health, energy, water, oceans, space, etc.). Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	1.5 Attitudes to the Government's science investments over the past 5 years	Measurement of public attitudes to Government STI investments over the <u>preceding</u> 5-year period	Attitudinal measure of public support for Government science investments. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
	1.6 Attitudes to the Government's science investment priorities for the next 5 years	Measurement of public attitudes to planned Government STI investments in the <u>subsequent</u> 5-year period	Attitudinal measure of public opinions of what STI investments the Government should focus on. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	1.7 Personal interest in S&T engagement	Measurement of personal interest by members of the public in various modalities of SE activity	Measure of public interest in and attendance at various SE events. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
2. Citizens' confidence in science and science institutions	2.1 Trust in science	Composite measure of 10 items about public trust in the work of scientists, the process of science, and the communication of science to the public	Composite measure of 10 items. 5 items will reflect higher-trust positions, while 5 items will reflect lower-trust positions. These will be balanced across the 3 attitudinal areas. Trust in science will be reported as a continuum. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	2.2 Trust in mainstream media science reporting	Attitudinal measure of trust in mainstream media science journalism. All modalities of mainstream media will be included among the items.	Trust in science, on a continuum from "highest trust" to "lowest trust", for each of the following modalities of science reporting: TV, print, websites, and radio. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	2.3 Trust in science institutions	Attitudinal measure of public trust in science institutions. These are limited to public institutions, and include universities, science councils, state-owned entities (SOEs), and national laboratories.	Trust in South African science institutions, on a continuum from "highest trust" to "lowest trust", for each of the following learning institutions: universities and TVET colleges; science councils and SOEs; museums, aquariums, zoos and science centres; and national laboratories. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
	2.4 Perceptions of transformation at science institutions	The change over time in public perceptions of transformation in various employment categories at science institutions. The transformation seeks to identify and strengthen areas of excellence.	Initial surveys will report on public perceptions of transformation at science institutions. The focus will be on transformation in respect of formerly disadvantaged people, women and people living with disabilities. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	2.5 Trust in the Government's evidence-based approach to decision-making	Measure of public trust in the Government's approach of using scientific evidence to inform decision-making	Initial data will report on public trust in Government evidence-based decision-making. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
3. Citizens' scientific literacy	3.1 Interest in selected scientific domains	Measurement of broad public interest in a range of scientific disciplines. Disciplines will be informed by historic national surveys of interest in science and may vary where required.	The indicator will adopt 6 to 10 items in a list of scientific domains. Respondents may be asked to indicate a specific level of interest along a continuum. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	3.2 Informedness regarding selected scientific domains	Measurement of broad public informedness about a range of scientific disciplines. Disciplines will be informed by historic national surveys of interest in and informedness about science and may vary where required.	The indicator will adopt 6 to 10 items in a list of scientific domains (as above). Respondents may be asked to indicate a self-elected level of informedness along a continuum. Informedness is the degree to which respondents feel informed about a specific topic. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	3.3 Interest in new scientific discoveries	Measure of public interest in new scientific discoveries	Indicator measuring the level of public interest in specific new scientific discoveries. Items may range across scientific domains; however, the topics will have been present in the mainstream media within the preceding reference period. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
	3.4 Recognition of different forms of knowledge (e.g. indigenous and Western forms of knowledge)	Quantification of public recognition of the various forms of indigenous knowledge and non-Western knowledge production recognised in the DSI Science Engagement (SE) Programme	SAPRS measure to include a series of items investigating public recognition of and engagement with different knowledge forms in the media, public forums and online materials. Awareness and engagement by the public to be measured through attendee numbers and types of events or products of the DSI SE Programme. The indicator includes attendees and audience segmentation. The reference period may be annual or across the 5-yearly SAPRS Survey reference period. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	3.5 Sources of scientific information	Assessment of various forms of public sources of scientific information	The indicator will adopt the categories present in media surveys and identify the main sources of S&T knowledge among the general public. Categories to include radio, television (digital and terrestrial), online news, social media, streaming (on-demand) content, books/magazines, newspapers, government sources, etc. Demographic disaggregation is possible.	Historic: SASAS (HSRC); First Measure: SAPRS 2023, then every 5 years
4. Citizens' knowledge of general and specific science areas	4.1 Awareness of South African scientific and technological discoveries	Retrospective look at public knowledge and awareness of South African domestic S&T achievements	Public awareness measured through a series of items representing recent domestic S&T discoveries – as defined. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
	4.2 Awareness of and informedness regarding contemporary natural phenomena	Citizen informedness and awareness regarding scientific explanations for natural phenomena. These may include weather phenomena (rain, wind, snow, etc.); soil, earth and climate phenomena; fauna and flora; and others where appropriate.	Public awareness measured through items representing recent natural phenomena reported through the mainstream media. Informedness relates to how knowledgeable citizens are, beyond awareness. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	4.3 Performance on a science knowledge index	A science knowledge index will be drawn up to measure public knowledge of scientific facts. (For an example of such an index, see Parker, 2017, pp. 291-4).	The indicator will be operationalised via a battery of 10 items requiring a “yes” or “no” response. The selection of discipline and categories of questions will include the natural and social sciences, toward a more inclusive definition of basic scientific literacy. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	Historic: SASAS (HSRC); First Measure: SAPRS 2023, then every 5 years
	4.4 Aspirations of youth (up to 35 years) to pursue STEM studies and careers	Sub-sample of youth (up to 35 years) within the SAPRS Survey who report aspirations to pursue STEM careers	Sub-sample based on age demographics will report on youth aspirations to pursuing STEM careers. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	4.5 Awareness and informedness regarding public science investments	Quantification of the level of public awareness and informedness regarding Government S&T investments within the reference period	Public awareness measured through items related to Government S&T investments reported through the mainstream media. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
5. Citizens' SE behaviour	5.1 Attendance at, or involvement in, public engagement activities	Measure of public attendance at and involvement in SE activities	Independent measure of citizen attendance at SE activities within the DSI SE Programme. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	5.2 Adoption of technologies in personal, work and civic spaces	Indicator representing technology penetration within society and its beneficial application in various spheres of life	Proportion of the public indicating adoption of beneficial technologies within various spheres of life. Mediated by various demographic characteristics (income, infrastructure, access). Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	5.3 Individual behaviour and motivation to contribute to positive societal change	Measure of individual agency, behaviour-change practices and motivation toward making a social contribution	Proportion of the public indicating adoption of behaviour or practical changes influenced by S&T knowledge in various spheres of life. Includes personal behaviour change as well as behaviour change related to the environment, health, etc. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years
	5.4 Behaviours related to STEM information sharing	Understanding public information practices that mediate STEM information acquisition and knowledge sharing. Particularly important within digital channels and a "post-truth", post-Covid-19 world.	Public behaviours related to information sharing in digital contexts. The reference period will be the 5-year reference period of the preceding SAPRS Survey. Demographic disaggregation is possible.	First Measure: SAPRS 2023, then every 5 years

Table 2b: Details of the Framework – Substantive Non-impact Measures

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
1. Citizens' attitudes to and perceptions of science	A1 R&D expenditure as a % of GDP	Proportion of GDP devoted to R&D expenditure. The measure expresses the degree of interest in, confidence in, and general attitude towards STI prevailing in the country.	Data is measured annually via official statistics. The DSI-HSRC R&D Survey headline indicator will be used toward an annualised data point as well as a 5-yearly average.	Historic: R&D survey; First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A2 Participation in STEM subjects in Grade 12	Proportion of Grade 12 learners participating in science subjects	TIMMS data, within each iteration. National dataset – as per DSI requirements.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A3 Expenditure on SE programmes as a % of total S&T expenditure	Proportion of total STI budget spent on SE activities, irrespective of funding source	Data from DSI and affiliates reporting via SEIMS	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A4 Content of SE programmes and science promotion activities	Subject domains and S&T topics covered within the SE programme of activities within a given reference period	Data from SEIMS as captured within the reference period by the DSI and its entities. Items include S&T focus areas and specific programmatic outcomes.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS..
	A5 Attendance at SE activities	General attendance at DSI SE programme-supported activities	Data from SEIMS as captured within the reference period by the DSI and its entities. Contributions will include number and type of SE activity, and attendance at, and target audience of, each activity.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
2. Citizens' confidence in science and science institutions	A6 Policy briefs and evidence-based recommendations from the DSI (and reporting institutions)	The number of knowledge products produced by the DSI and its entities supporting dissemination and knowledge mobilisation	Contributions from the DSI and its entities supporting policy brief and evidence synthesis activities as captured within SEIMS	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A7 Presence of scientists on Government advisory boards	Measure of the number of scientists and researchers present in an advisory role on advisory boards	Formulation of an audit of advisory boards and their constituent members as captured within SEIMS	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
	A8 Citizen-centred dialogues	The number of citizen-centred dialogues hosted by the DSI and its entities	Indicator reporting on the number and geographical dimensions of the various types and modalities of DSI citizen-centred dialogues. Data to be captured within SEIMS.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A9 Science and technology public hearings	The number of science and technology public hearings hosted by the DSI and its entities	Indicator reporting on the number and geographical dimensions of the various types and modalities of DSI science and technology public hearings. Data to be captured within SEIMS.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A10 Policy instruments for transformation	The number of policy instruments developed and directed toward enhancing transformation by the DSI and its entities	Indicator reporting on the various types and modalities of DSI policy instruments leveraged toward advancing transformation across the NSI. Data to be captured within SEIMS.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A11 Demographics of STEM personnel in science institutions	The detailed demographic constitution of the national STEM workforce at DSI-supported science institutions	Indicator reporting on the various demographic make-up of the national STEM workforce. Disaggregation by qualification, race, gender, location, and scientific discipline is possible. Various data sources may be considered, depending on the level of detail required.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A12 Value of government financial contributions (e.g. DSI grants, scholarships, research grants) to historically disadvantaged STEM staff and institutions	The value of total public funding support to historically disadvantaged STEM staff and institutions	Raw data recorded within SEIMS relating to Government and DSI support to STEM institutions and staff. Disaggregation by staff demographics, location and scientific discipline is possible.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
3. Citizens' scientific literacy	A13 Strategic interventions to protect and advance indigenous knowledge systems	The number and type of interventions introduced by the DSI within the reference period toward advancing Indigenous Knowledge Systems (IKS) work streams	Data from strategic interventions initiated by the DSI and its entities toward protecting and advancing IKS research to be recorded via SEIMS. Data will include the number and types of interventions as well as their geographic target locations.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A14 Coverage of science topics in identified media sources	Analysis of social engagement across the DSI and its entities. Engagements to be clearly defined within the context of the social media landscape.	Data from various media analysis sources to be integrated into SEIMS reporting. Data to be disaggregated according to DSI specifications.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A15 Public engagement on science topics on social media	Analysis of media coverage related to specified science topics as per the DSI priority science areas reported within an array of mainstream media sources	Data from various social media analysis sources to be integrated into SEIMS reporting. Metadata and related engagement analytics to be used to support this indicator. Data to be disaggregated according to DSI specifications.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
4. Citizens' knowledge of general and specific science areas	A16 Success in STEM subjects at Grade 10 and 12 level	Indicator supporting the development of a strategic pool of suitably educated youth as a strategic non-impact measure of citizens' attitudes to science	Data reported into SEIMS on learner achievement in Grade 12 STEM subjects	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A17 South Africa's performance in TIMSS and % of learners achieving above the minimum competence level	Total performance by domestic learners within the TIMSS assessment. Comparable to various international counterparts.	TIMMS data, within each iteration. National dataset – as per DSI requirements.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A18 Learners who participate in DSI school-based SE programmes and subsequently enrol for STEM subjects at HE or TVET institutions	Total number of learners who participated in DSI-supported SE programmes and subsequently enrolled at institutions of higher learning	Data reported into SEIMS on learner participation and enrolment at HE and TVET institutions	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.

IMPACT THEME	IMPACT MEASURE	DESCRIPTION	CALCULATION METHOD	TIME PERIOD
	A19 Participation in and completion of STEM subjects at HE and TVET level	Enrolment and completion numbers for STEM courses at HE institutions and TVET colleges within the reference period	Data reported into SEIMS on enrolment and completion of courses at HE and TVET institutions	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A20 Schools participating in extra-curricular STEMI activities	National learner participation in extra-curricular STEMI activities within the reference period	Participation at a national level of learners in extra-curricular STEMI activities. Demographic and geographic disaggregation are possible.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
5. Citizens' SE behaviour	A21 Deployment in schools of technologies supporting STEMI learning and teaching	Assessment of school technology deployment in support of STEMI learning and teaching activities	The number of public schools using technology in the classroom. Data to be integrated into SEIMS reporting. Reference period may be annualised and related to the 5-yearly SAPRS Survey.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A22 Major behaviour-changing campaigns related to STEMI led by various government departments over a specified period	Review of the behaviour-change campaigns, supported by STEMI evidence, initiated by government departments	Total number of campaigns to be recorded within SEIMS on an annualised basis by the DSI and its entities.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.
	A23 Behavioural incentives introduced to address STEMI issues (such as health, climate change, energy, pollution)	Number of incentives designed to support and encourage positive behaviour across the South African population based on STEMI evidence	The number, type and modalities of behaviour-change incentives introduced by the Government and its entities to direct positive social and environmental impacts. The DSI and its entities to record data within SEIMS.	First report: with SAPRS 2023, then every 5 years. Data remains available annually via SEIMS.

APPENDIX 1: DEFINITION OF KEY CONCEPTS ►

CONCEPT	DEFINITION
Attitude	Degree of like or dislike for something, influenced significantly by individual experience, temperament and social context (Pickens, 2005; Reddy, Juan, Gastrow and Bantwini, 2009).
Indigenous Knowledge System (IKS)	Local knowledge that is unique to a given culture or society and usually passed on from generation to generation by word of mouth (Fien, 2010).
Informedness	The state, level or quality of being informed (on general or specific topics) (Parker, 2017).
Interest in science	A state of curiosity or concern about, or attention to, science and technology (Reddy et al., 2009).
Perception	Formation of personal understanding of a concept (such as the concept of science and technology) through the collection, organising, interpretation and meaning-making process of what is subjectively experienced (Pickens, 2005; Reddy et al., 2009).
Public engagement with science	Activities, events or interactions that are characterised by mutual learning among people of varied backgrounds, scientific expertise and life experiences, who articulate and discuss their perspectives, ideas, knowledge and values (McCallie et al., 2009).
Publics' relationship with science	A bidirectional connection or association between multiple publics and science and technology (Reddy et al., 2009).
Science	Encompasses systematic knowledge spanning the natural and physical sciences, engineering sciences, medical sciences, agricultural sciences, mathematics, social sciences, technology, all aspects of the innovation chain, and indigenous knowledge (DST, 2015).
Science communication	The use of appropriate skills, media, activities and dialogue to produce one or more of the following personal responses to science: awareness, interest, enjoyment, opinion formation and understanding (Burns, O'Connor and Stocklmayer, 2003).
Science engagement (SE)	An overarching term that covers all aspects of public engagement with science, science communication, science literacy, and science outreach and awareness (DST, 2015).
Science knowledge index	A composite index of knowledge-based items related to specified fields of science (Parker, 2017, pp. 291-4).
Science awareness	The ability to perceive, or to be conscious of, science events, objects or patterns, which does not necessarily imply understanding (Reddy, Juan, Gastrow and Bantwini, 2009).
Scientific knowledge	The assimilation of science and technology facts and principles (Reddy et al., 2009).
Scientific literacy	People are scientifically literate to the extent that they are aware of, interested and involved in, form opinions about, and seek to understand science (Burns, O'Connor and Stocklmayer, 2003).
Stats SA	Statistics South Africa
Trust	Trust is a multifaceted construct including affective and cognitive perspectives (Dunn and Schweitzer, 2005).
Youth	People aged between 15 and 34 years (Stats SA).

APPENDIX 2: ABBREVIATIONS

CHE	Council on Higher Education
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DPME	Department of Planning, Monitoring and Evaluation
DSI	Department of Science and Innovation (Previously the Department of Science and Technology)
EMIS	Education Management Information System
GDP	Gross Domestic Product
HE	Higher Education
HEMIS	Higher Education Management Information System
HSRC	Human Sciences Research Council
ICT	Information and Communications Technology
IKS	Indigenous Knowledge Systems
MEF	Monitoring and Evaluation Framework
NGO	Non-Governmental Organisation
NRF	National Research Foundation
R&D	Research and Development
R&D Survey	South African National Survey of Research and Experimental Development
SAASTA	South African Agency for Science and Technology Advancement
SAPRS Survey	South African Public Relationship with Science Survey
SASAS	South African Social Attitudes Survey
SE	Science Engagement
SEIMS	Science Engagement Information Management System
SES	Science Engagement Strategy
SOE	State-Owned Entity
STEM	Science, Technology, Engineering and Mathematics
STEMI	Science, Technology, Engineering, Mathematics and Innovation
STI	Science, Technology and Innovation
S&T	Science and Technology
TIMSS	Trends in International Mathematics and Science Study
TVET	Technical and Vocational Education and Training

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