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Mapping EU Policies with the 2030 Agenda and SDGs

*Fostering Policy Coherence
through text-based SDG Mapping*

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Abstract

The UN 2030 Agenda and its SDGs are increasingly gaining momentum as a vehicle to foster a sustainable development transition. The European Commission is a frontrunner in this transition process and its political priorities are strongly linked with the SDGs, firmly anchoring them in the centre of the EU policy cycle. This report investigates the way in which SDGs are mainstreamed into policy making processes by analysing how the policy initiatives of the current Commission are semantically linked to the 2030 Agenda and to SDGs. The identified goals and targets well reflect the transversal political priorities (for instance SDG 13 on climate change in line with the Green Deal initiative) and the policy response to the various challenges posed by the Covid-19 pandemic (SDG 3 on health and SDG 8 on sustainable economic growth). The mapping highlighted most relevant policies for specific SDGs, as well as SDGs that are more universally addressed across policy initiatives. The analysis also revealed potential gaps where policies did not seem to adequately address certain aspects of the 2030 Agenda (e.g. SDG 5 on gender equality). EU policy making processes show a tendency towards more integrated policy perspectives, as political priorities and their underlying initiatives address SDGs in a more systemic manner. The method applied for this analysis capitalises on a text mining pipeline through which policy documents are processed and screened for SDG-related keywords. In contrast to more technologically advanced Artificial Intelligence-based approaches, the methodology utilised in this report does not remain a black box but provides transparent and robust results on the semantic links between the SDGs and EU policy documents that can be easily communicated to inform future policy making processes.

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A first exercise to associate EU policy documents to SDGs was developed at the JRC in 2017 by Miola A., Borchardt S., Neher F., Buscaglia D. (2019). Following up on this analysis, the authors designed and applied a new approach by developing an automated computational text mapping that has been used for the assessment of EU policies. The work of (Miola et al., 2019) is acknowledged.

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1 Introduction

1.1 Setting the scene: SDGs and EU policy context

Starting from the first industrial revolution, continuous economic and industrial growth is compromising the planet's ability to regenerate its resources and to sustain life on earth, while also increasing social disparity and humanitarian crises (Meadows et al., 1972). Since 1972 the United Nations have called all nations for action against this trend and set the objective to achieve sustainable development: a development paradigm enabling current generations to fulfil the needs without compromising the ability of next generation to fulfil theirs. The UN Millennium Declaration adopted in 2000 committed world leaders to a new global partnership to meet the needs of the world's poorest, setting out the eight Millennium Development Goals to combat poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women. In 2015 with the resolution 70/1 the UN's General assembly has adopted the 2030 Agenda for Sustainable Development which renews the previous commitments and represents their evolution towards sustainability and human rights. The agenda sets the 17 Sustainable Development Goals (SDGs) and 169 targets to achieve full economic, social and environmental development without trespassing the planetary capacity.

Since their formulation in 2015, the role of the SDGs has become more and more important, especially in the last two years, due to the Covid-19 pandemic and its consequent socio-economic crisis. Even before the outbreak, the world was not on track to reach the SDGs, but the Covid breakdown marked a strong setback in their achievement, exacerbating social and economic inequalities (UN, 2020; SDSN and IEEP, 2020; UNSDG, 2020; Abidoye et al., 2021), Consequently there is the urgent need to strengthen the effort in aligning the policies and programmes worldwide to the 2030 Agenda.

For the European Union (EU) sustainable development is a core principle, firmly anchored in the European Treaties. The EU and its Member States are strongly committed to the 2030 Agenda, as outlined in the Communication "*Next steps for a sustainable European future*" (EC, 2016), which stated the SDGs integration into the European policy framework and Commission priorities. An important step towards the implementation of the SDGs is the release of the Reflection Paper "*Towards a Sustainable Europe by 2030*", in January 2019, which provides an overview of the contributions of the Juncker Commission to the 2030 Agenda, first outlining the main policy highlights and then providing a list of different actions that were taken on each of the SDGs. (EC, 2019).

Furthermore, sustainability is an overarching principle in the current Commission and the 2019-2024 strategic agenda sets the achievement of the 2030 Agenda as one of its main objectives (European Council, 2019). A central contribution to the SDGs across policies is highlighted in the document "*Delivering on the UN's SDGs – A comprehensive approach*", published in November 2020. Among key strands on how the Commission's political programme addresses the SDGs (Figure 1), there is the refocus of the European Semester for the economic governance into an instrument that integrates sustainable development, giving Europe the means to build an overarching strategy on SDGs.

According to the new strategy, in the 2020 Semester cycle the country reports included, for the first time, a chapter on environmental sustainability, integrated SDGs in the various other sections, and added a dedicated annex reporting on Member States' overall SDG performance.

Another important step is mainstreaming the SDGs in policymaking using better regulation tools. Actually, sustainability has been identified as a key aspect for policy impact assessment since 2001 (EC, 2001), but it was only with the communication adopted in April 2021 that an explicit reference to the contribution of every legislative proposal to the 2030 sustainable development agenda (EC, 2021) was required.

Figure 1. Von der Leyen Commission’s comprehensive approach for SDGs



Source: EC 2020, SWD (2020) 400 final.

This commitment is even more important considering the global Covid-19 pandemic, aiming at ‘building back better’ towards a more inclusive, sustainable, just and resilient future for all, according to the ‘*leaving no one behind*’ principle.

In May 2020 the Commission presented the European Recovery Plan, consisting of a revised Multiannual Financial Framework 2021–2027 and the recovery instrument Next Generation EU. In the documents that describe the EU Recovery Plan the 2030 Agenda and its goals are explicitly mentioned, in particular SDG 3 on health and wellbeing and SDG 8 on decent work and economic growth. Along the narrative of the text, all the three main dimensions of sustainable development – environmental, social and economic – are tackled and keywords referring to the 17 goals and 94 targets have been detected (Borchardt et al., 2020). Moreover, in line with the objectives of the Recovery and Resilience Facility, Member States’ national Recovery and Resilience Plans (RRPs) should contribute to the achievement of the SDGs with continued monitoring.

This concise policy overview clearly shows how the European Commission is strictly committed to the 2030 Agenda and how the SDGs can provide a roadmap towards a sustainable future. What remains unclear is how the Commission’s policies have concretely contributed to each SDG and its targets, which are the areas of highest investment, and which are the gaps and challenges remaining within each dimension of sustainability.

The complex and interconnected nature of the economic, social, and environmental challenges that policy makers are facing relies on an integrated solution, that also requires the ability to shorten the gap between data, knowledge, policy and impact assessment.

The mapping of EU policy actions into the space of the SDGs can contribute to the mainstreaming of the 2030 Agenda into the European Union and its policy landscape. A better understanding of the relationship between EU policies and the 2030 Agenda with its 17 goals and 169 targets can also support policy coherence for sustainable development in a European policy context, namely the strengthening of the EU capacity to design, implement and monitor coherent and integrated policies for sustainable development. Implementing the SDGs through a coherent set of actions represents a major challenge to governments.

This mapping exercise, as described in the next chapters, allows to better understand:

- how EU policies cover the SDGs at the goal and target-level,
- the main areas of intervention,
- potential gaps in addressing SDGs,
- which policies are the most cross-cutting ones,
- the interlinkages already existing among EU policies,
- the coherence of EU policy initiatives

In this way the mapping offers useful information to plan dedicated actions to fill the gaps and foster policy coherence for sustainable development.

1.2 Fostering Policy Coherence for Sustainable Development

The integrated nature of sustainable development implies the systemic interdependence between goals and effectiveness of policies implemented to achieve them. The 2030 Agenda acknowledges this issue and addresses it by setting global partnership as one of its 17 goals. In particular, the promotion of Policy Coherence for Sustainable Development (PCSD) is one of the 169 targets of the 2030 Agenda and considered a key means of implementation. This implies that in order to address the challenges related to progress towards sustainability across different sectors, governmental and geographical scales, it is necessary that the deployed policies and operations are not conflicting: an action contributing to progress toward one goal shall not reverse progress towards other goals, but rather foster a virtuous cycle among them.

The European Union has a long tradition on policy coherence for development (PCD), with a first conceptualization introduced in 1992 in the Treaty of Maastricht and further reinforced in the Treaty of Lisbon in 2007. More recently, building on the 2030 Agenda, the New European Consensus on Development affirms that “PCD is a fundamental part of the EU’s contribution to achieving the SDGs”. According to the new Consensus, the PCD is applied across all policies and all areas covered by the 2030 Agenda, namely the so-called five Ps visualized in Figure 2: the social, economic and environmental dimensions together with the ethical one and the universal engagement. Special attention is paid to trade, finance, environment and climate change, food security, migration and security.

Figure 2. The five Ps of the Agenda 2030



Source: UN, 2015.

Greater coordination and coherence between EU and Member states actions is considered a means to increase effectiveness of policy to promote the implementation of the 2030 Agenda, development effectiveness is indeed seen as fundamental element for achieving SDGs.

Art 109 of the Consensus compares the concepts of PCD and PCSD. It states that “The EU and its Member States reaffirm their commitment to Policy Coherence for Development (PCD), which requires taking into account the objectives of development cooperation in policies which are likely to affect developing countries. This is a crucial element of the strategy to achieve the SDGs and an important contribution to the broader objective of Policy Coherence for Sustainable Development (PCSD). The 2030 Agenda provides new impetus for the EU and its Member States to formulate and implement mutually reinforcing policies”.

The 2019 EU Report on Policy Coherence further clarify the difference between the two concepts of policy coherence: “Despite their semantic proximity, there is a fundamental difference between PCD and PCSD. PCD is a legal obligation in the EU Treaty, whereas PCSD stems from the 2030 Agenda and the Addis Ababa Action Agenda. In addition, in the case of PCSD, given that the SDGs are universal, policy makers have to secure multi-directional coherence by pursuing multiple goals globally, whereas for PCD, coherence is more focused, i.e. it is directed towards a single cause, which is the interest of developing countries”.

Overall, the commitment on policy coherence of the European Union can be therefore considered twofold, not only as a legally binding duty towards developing countries but also as a broader engagement to effectively implement the 2030 Agenda.

To achieve policy coherence, the OECD has assembled a specific recommendation, where PCSD is defined as: “an approach to integrate the dimensions of sustainable development throughout domestic and international policy-making. Its objectives are to advance the integrated implementation of the 2030 Agenda by: (i) Fostering synergies and maximising benefits across economic, social and environmental policy areas; (ii) Balancing domestic policy objectives with internationally recognised sustainable development goals; and (iii) Addressing the transboundary and long-term impacts of policies, including those likely to affect developing countries” (OECD, 2019).

Figure 3 shows the eight principles that OECD proposed in the Recommendation to enhance PCSD under three main pillars: i) strategic vision and leadership; ii) coordinated actions; iii) impact assessment.

Figure 3. OECD comprehensive approach for SDGs



Source: OECD, 2019.

The first one is the clear political commitment and leadership to enhance PCSD guided by strategic vision for the implementation of the SDGs. At EU level, this pillar is well acknowledged. The Reflection paper “Towards a Sustainable Europe by 2030”⁽¹⁾ released in January 2019 embraced the 17 SDGs, sustaining the need of a leading governance to shape the EU agenda around sustainable development and its long-term implementation. Later, President von der Leyen, outlining the six political priorities to shape the working programme of the Commission for 2019-24, proposed to explicitly refocus the European Semester towards the SDGs. More recently, the Staff Working Document “Delivering on the UN’s Sustainable Development Goals”² calls for policy coherence between the EU budgetary policies and the SDGs and for the effort to improve the quality and coherence of the policy development process through better regulation practices.

The second pillar is the effective and inclusive institutional and governance mechanisms to address policy interactions across sectors and align actions between levels of governments. The exercise of policy mapping towards SDGs proposed in this document is going towards the measurement of how policy commitments and

¹ COM(2019) 22 final available at EUR-Lex webpage: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0022&from=EN>

² SWD(2020) 400 final available at https://ec.europa.eu/info/sites/default/files/delivering_on_uns_sustainable_development_goals_staff_working_document_en.pdf

actions are aligned with sustainable development objectives, at goal and target level, among different sectors and along the different EC Directorate-Generals. The analysis can consequently foster the institutional implementation of a policy mechanism to finally reach coherence in policy makers actions at all Commission level.

The third OECD pillar is a set of responsive and adaptive tools to anticipate, assess, and address domestic, transboundary and long-term impacts of policies. The EC impact assessments are extensively carried out on initiatives expected to have significant economic, social or environmental impacts to improve the quality of EU legislation. Assessments represent a key part of the Better Regulation agenda, set to design policies able to achieve their objectives in the most effective and efficient way.

2 Mapping EU policy actions with the SDGs

A crucial step in mainstreaming the SDGs into the EU policy landscape is to understand how EU policies relate to the 2030 Agenda. Contextualising those policies with the SDGs can help in identifying focal points in the SDG framework as well as potential gaps to which political attention can be alluded to in future policy making processes. However, the complexity of the SDG framework with all its goals, targets and indicators poses a great challenge to policy makers who aim at such contextualisation. In order to support this process, the JRC initially carried out a mapping exercise in which EU policies mentioned in the Strategic and Management Plans of 2016–2020 of DGs were manually scanned by respective SDG experts for relevant goals and targets inside the documents (Miola et al. 2019). As this qualitative approach is time- and resource-consuming, and includes a certain degree of unavoidable subjectivity, an automated text mining approach has been developed, allowing to process large amounts of policy documents in a timely manner and with robust results on the goal- and target-level.

There are different approaches to automatic text classification and with Artificial Intelligence (AI) and Machine Learning (ML) solutions being on the rise, methods, tools, and fields of application are ever expanding (Nosratabadi et al. 2019). However, certain classification problems still pose great challenges to these new methodological approaches, depending on the complexity of the classification problem (number of classes), data availability (accurate and exhaustive training data sets) and many other aspects related to the methods themselves (prediction accuracy, computational resources required, spurious correlations vs. causation, etc.). In the case of the SDG mapping, the classification problem with 17 goals and 169 targets is particularly complex and availability of high-quality labelled input data for all these classes is extremely difficult to obtain. Prior to the analysis presented here, Machine Learning algorithms like Support Vector Machines (SVMs) or Naïve Bayes have been trained and tested on a set of several thousands of peer-reviewed academic journal abstracts retrieved through the Scopus Application Programming Interfaces (API) which were manually labelled by SDG experts. As a starting point, those algorithms were trained to make predictions on the goal-level as this already proved to be a challenging task, being a non-binary classification problem with 17 different classes. The highest prediction accuracy was achieved with the SVM algorithm at around 84%. Considering that this means on average 16% of false predictions and that these predictions are applied to the vector representations of the classified text, the quality of the outcomes can vary greatly, and the results would need careful validation by respective experts.

For this reason, the approach presented here in the report takes a step back from the advancing AI and Machine Learning methods and elaborates instead, in a more robust and pragmatic way, on classic text mining and natural language processing techniques (Bird et al., 2009) by utilising complex keywords embedded within a specifically designed SDG text classification workflow. To achieve this, a comprehensive set of SDG-related keywords on the goal- and target-level was defined in an iterative process involving various experts from different fields. Relevant EU policy documents were identified and retrieved from Eurlex before they were further processed through a text processing pipeline. This pipeline consisted in cleaning the text from special characters, protecting special words from spurious stemming, stemming the text using the Porter stemming algorithm implemented in the NLTK python library (Bird et al or NLTK reference), reverting special word from stemming protection and removing the stopwords. The processed text was then screened for relevant keywords using string matching and the resulting keyword frequencies were aggregated to the goal- and target-level to obtain meaningful insights on the semantic prevalence of the respective SDGs inside the documents. The following sections will describe the process towards an automated SDG mapping methodology and further explain the individual steps of the approach outlined above.

2.1 Towards an automated SDG mapping approach

Starting in 2017, the first manual mapping exercise considered a large set of EU actions implemented during the Juncker Commission, identifying the linkages with the 169 UN targets of the 2030 Agenda for the Sustainable Development. Relevant policy initiatives extracted from the Strategic and Management Plans 2016 – 2020 were manually related to EC official documentation, mainly Communications, Regulations, Decisions and Directives, and manually retrieved from the EUR-Lex portal. In a next step, those initiative were then linked to the SDGs and their targets through textual analysis carried out by a group of experts. The resulting database of EU policies mapped into SDGs was then finalised in cooperation with each Directorate-General dedicated to the respective policy initiatives (Miola et al., 2019). The mapping provided extensive results for each policy initiative and laid out the necessary groundwork for the subsequent mapping in which a more automated approach has been applied.

As a second step, a review of EU policies was performed in 2020, in order to update the mapping and include all the actions listed in the EC Secretariat-General reflection paper “Towards a sustainable Europe by 2030” (COM/2019/22 final). This update marked an effort to overcome potential weaknesses of the first version: it was conducted in an automated way by utilising text mining techniques in order to provide coherent mapping results in a timely manner. Though the first version proved to be enormously comprehensive, it required a lot of time and resources, as well as an efficient coordination of efforts and communication across various Departments inside the Commission. On the contrary, the automated approach of the second mapping saved time and resources and made the analysis more objective, reaching a common agreement on the results by all the experts, mainly ruling out potential subjectivity in attributing relevant SDG targets to each policy.

In a third step, the automated mapping approach was combined with the programmatic document retrieval from the EUR-Lex database through the Cellar semantic repository of the Publications Office (2018) accessed from the eurlex R package (Ovádek, 2021).

The mapping was performed on the legislative initiatives of the current Commission, starting from its establishment until 31st December 2020 and including further refinements and improvements of both the set of keywords and the codebase. Accessing the EUR-Lex database in an automated way allows to create a comprehensive and coherent data set of EU-policy documents to which the automated SDG mapping approach can be applied to.

With the advancing digital transformation an ever-increasing amount of data is being generated, making the manual processing by human experts more and more difficult. Tools like the approach presented in this report can help to structure and process large amounts of data and to retrieve relevant information in a timely manner, using them to support policy makers and other stakeholders in their decision-making processes.

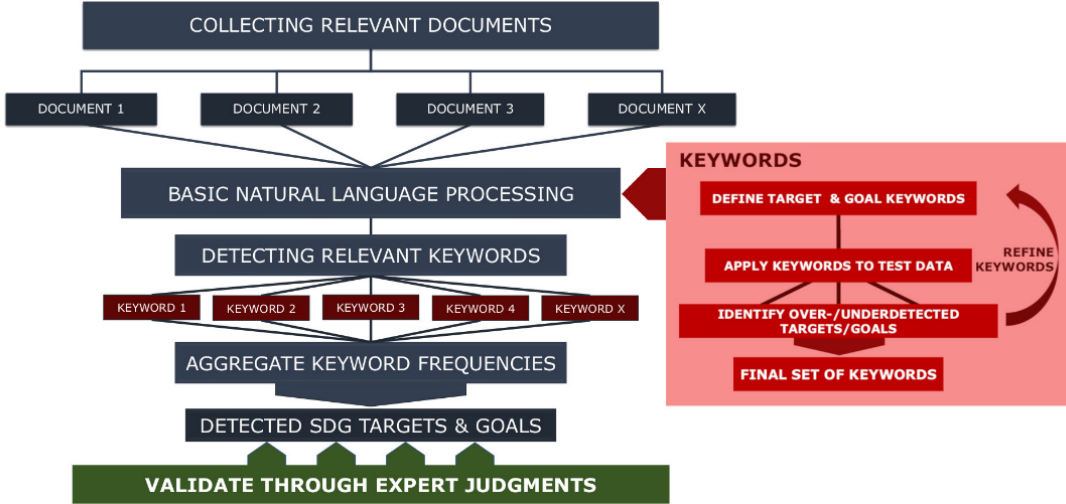
2.2 Mapping process and text mining techniques

The mapping of the legislative initiatives was performed through the following steps:

1. Definition of keywords
2. Selection and access to the legislative initiatives
3. Retrieval of the document texts
4. Text processing and target detection in the documents
5. Interpretation of Mapping Output

Figure 4 further illustrates the workflow under which each of these steps were processed and linked to each other.

Figure 4. Main steps of the Mapping Process



Source: Authors' elaboration.

2.2.1 Selection and access to the legislative documents

The Publication Office of the European Union maintains the database of EU publications, laws, and data, and provides access to those resources by different means. Access to EU laws is available through the EUR-Lex portal³. The Cellar interface enables programmatic access to the legislative resources by using semantic web technologies which enables retrieval of a selected body of documents. Documents are selected based on the semantic properties of the database that can be queried using SPARQL language through the cellar interface. Further details are available from the document describing the Cellar interface (Publication Office, 2018) Recently, the eurlex R package was developed and released by an independent researcher (Ovádek, 2021) This package allows simplified access to the EUR-Lex database and document content retrieval for computational text analysis. The package is comprised of different functions that enable users to easily execute a set of SPARQL⁴ queries designed for the most common use-cases. Various parameters in the respective functions can be adjusted to query and retrieve the relevant information about specific subsets of documents that users are interested in. Queries can target specific document types (e.g. Regulations, Decisions, Communications, etc.) or documents belonging to a particular Celex sector (sector code 3 on legal acts or sector code 5 on preparatory documents).

2.2.2 Retrieval of the document texts

For the mapping of the current Commissions' initiatives, documents falling under Celex sector code 3 (legal acts) and code 5 (preparatory documents) were retrieved by running SPARQL queries through the eurlex R package. As specific time periods can currently not be specified in the eurlex R package when creating the query, the query results had to be filtered subsequently by their publication date, considering only documents published between 01/12/2019 and 15/01/2022. The filtered set of documents (4054 legal acts and 2236 preparatory documents) had to be further refined by selecting relevant legal acts and preparatory documents authored by the European Commission (see Table 1), and by removing orphan entries without a Celex code. Afterwards, the raw text of the documents was obtained from the R eurlex package and saved offline for the analysis as plain text files. The final set of documents featured 4002 Legal Acts and 2217 Preparatory Documents.

Table 1. Types of documents included in the analysis

Legal acts (Celex sector 3)		Preparatory documents (Celex sector 5)	
Celex descriptor	Document Type	Celex descriptor	Document Type
<i>R</i>	Regulation	<i>PC</i>	COM – legislative proposals, and documents related
<i>L</i>	Directive	<i>DC</i>	Other COM documents (green papers, white papers, communications, reports, etc.)
<i>D</i>	Decision	<i>JC</i>	JOIN documents
<i>H</i>	Recommendation	<i>SC</i>	SEC and SWD documents
<i>G</i>	Resolution		
<i>C</i>	Declaration		

Source: Authors' elaboration, based on EUR-Lex website⁵

³ <https://eur-lex.europa.eu>

⁴ <https://michalovadek.github.io/eurlex/articles/eurlexpkg.html>

⁵ https://eur-lex.europa.eu/content/tools/TableOfSectors/types_of_documents_in_eurlex.html

2.2.3 Defining keywords

The identification of SDGs within each document has been conducted using text mining techniques. The identification is performed by recognition of actions and terms related to goals and targets of the UN 2030 Agenda through keyword matching. In order to provide an appropriate level of granularity for mapping SDGs, keywords are defined on the target- and the goal-level. The keywords, consisting of one or multiple terms, have been defined by a team of experts based on the definition of goals, targets, and indicators of the SDG agenda. Those keywords were gradually refined in an iterative process by counting them in the old set of policy initiatives mentioned above (Miola et al. 2019).

The findings of the manual mapping exercise served as baseline for validating the results of the automated approach and helped in rectifying over- or under-detected targets and their underlying keywords. Defining appropriate keywords that can be attributed to the respective goals and targets is one of the most crucial steps in this automated approach and requires expertise from different fields as well as careful cross-checking and validation as these keywords will largely determine the quality of the final outcomes. Targets may address complex multidimensional concepts that can be difficult to grasp with a set of keywords and they may also thematically overlap, especially targets capped under one goal – making a clear distinction between them a challenging task. As keywords on the target-level are quite complex and context-specific, a simple aggregation to the goal-level might not be enough to capture the relevance of certain SDGs inside a text. Therefore, additional keywords were defined also for the goal-level, being slightly more generic in nature in order to obtain a more coherent picture of how SDGs are covered on both – the goal- and the target-level inside a document.

We acknowledge the fact that the definition of keywords resembles a qualitative step in our approach where potential biases by the respective experts are introduced and thus, may impact the mapping results. The involvement of experts from different fields as well as a careful reviewing process of suggested keywords shall help in addressing this aspect. The final set of keywords is comprised of more than 3500 keywords: 3253 keywords on the target-level and 257 keywords on the goal-level.

2.2.4 Text processing and target detection in the documents

Due to the complexity of the defined keywords that are usually a composition of various words, the detection of those keywords in a given text can be challenging. Plural or singular forms of the words, different conjugations, interchangeably used synonyms, varying order of the words or different prepositions in between the thematic concepts targeted can prevent a successful detection. While some of these aspects can be addressed in the process of defining the keywords, like the consideration of synonyms and different word orders, others can be addressed through basic text mining techniques. In the SDG text classification workflow presented here, several text pre-processing steps were applied to both - the document text and the list of keywords. Those steps encompass the removal of punctuation and special characters, lowercasing of all words, as well as stemming of words and removal of stop words. Stop words are a set of generic words that do not entail any relevant meaning for the respective sentence and can therefore be removed (e.g. conjunctions, prepositions, articles as well as certain adverbs). Stemming describes the process of reducing words to their word roots in order to capture keywords' morphological variants and it is common step in Natural Language Processing (NLP). When applying stemming algorithms, words can potentially be over- or under-stemmed, meaning that words that actually have different stems are being stemmed from the same root (over-stemming) and eventually lead to false positives (*'university'* and *'universe'* are stemmed to the same root *'univers'*), whereas under-stemming refers to words that do have the same stem but are then stemmed from different roots and potentially lead to false negatives (*'alumnus'* → *'alumni'*, *'alumni'* → *'alumni'*, *'alumna'*/*'alumnae'* → *'alumna'*). To account for potential false positives, certain words were excluded from the stemming process. There are several stemming algorithms available in Python, with slight differences in performance and the way words are being stemmed. For the SDG mapping workflow, the Porter stemmer algorithm from the NLTK library was employed⁶ (Porter, M. 1980) "An algorithm for suffix stripping." Program 14.3 (1980): 130-137.). Apart from these text pre-processing steps, special cases like abbreviations (RD, R&D, HIV) or hyphenated words (detecting both "climate-resilient" and "climate resilient") needed to be considered as well. Applying all these text processing techniques can help in simplifying the analysed text to an extent, that no meaningful information is lost, while simultaneously, the probability of detecting relevant

⁶ <https://www.nltk.org/api/nltk.stem.porter.html?highlight=porter#module-nltk.stem.porter>

keywords is increased. In this way, the keyword matching procedure is optimised by enabling proper term identification.

The keywords matching approach offers two important advantages over text classification with ML: first, the interpretation of the results is direct and transparent compared to the algorithmic-based classification of conventional ML models. Second, establishing and validating an accurate ML model capable of identifying a high number of classes would require complex validation steps, high training time, and a training dataset that would be effortful to establish.

2.2.5 Interpretation of the mapping output

After processing both – the text of the document that needs to be analysed and the list of keywords – the document text is screened for the respective keywords and matches are being recorded in a data frame in Python. This output data frame keeps track of the document's Celex code, the detected keyword, the corresponding target or goal, the frequencies of the detected terms as well as the respective document length. In a next step, the detected keywords and their frequencies need to be meaningfully aggregated to the target- and the goal-level. While aggregating frequencies under one goal/target is technically simple, the interpretation of aggregated keyword counts can be complex, especially when comparing counts between documents of different length, but also when looking at frequencies of targets and goals inside the same document. For instance, the relative importance of a target inside a text can differ if one of its corresponding keywords is detected once in a 2-page document or once in a 10-page document. Additionally, the quality and preciseness of keywords can also influence how strongly a text is semantically linked to an SDG as some keywords are more closely aligned with goals' and targets' objectives than others. However, the iterative refinement of keywords (see chapter 2.2.3) led to a consolidated list of keywords in which each detection of a keyword implies a reliable semantic connection between the text and the respective SDG.

In previous mapping exercises, an aggregation rule was applied, taking text length, keyword frequencies and number of different keywords corresponding to the same goal/target into account (e.g., "IF text length greater than 100.000 characters only keep targets that have keyword count greater than 10 AND/OR number of different keywords detected greater than 3"). While this aggregation rule proved to provide accurate findings by eliminating the majority of false positives, it also ruled out a lot of targets potentially relevant in a document text, where keyword frequencies were too low in relation to the overall document length. Due to the gradual refinement of keywords over several iterations in which the SDG mapping approach was applied, generic keywords were either discarded or further refined. This refinement paired with slight adjustments of the aggregation rule helped to further increase the accuracy of the final mapping output, ensuring that potential false negatives are avoided. Through gradual improvements in the quality of the keywords, the aggregation rule could eventually be phased out and was not applied in the mapping presented in this report. However, low keyword frequencies were qualitatively double-checked by SDG experts on a sample basis to ensure robustness of the findings. While the interpretation and analysis of keyword frequencies can be crucial on the individual document level, the quantitative lens applied to the present mapping, mainly focuses on the number of documents addressing specific SDGs and targets. In addition to this indicator, keyword frequencies were used to further complement the findings, helping to better contextualise specific insights.

When looking at the final results of the mapping process, it is important to keep in mind what these results represent and where they come from: the automated mapping approach is based on keyword matching and provides a statistical analysis of a text. This analysis enables to obtain a semi-quantitative overview on how a text is conceptually related to a body of terms that summarize actions and concepts of the 2030 Agenda for Sustainable Development. From a text mining or Natural Language Processing perspective, this means that unstructured text is being processed, structured, and classified in order to provide a thematic overview through the detected keywords and its corresponding SDGs. More precisely, it is a semantic analysis based on keyword frequencies and document occurrences, meaning that it indicates which keywords were detected how many times and how many documents addressed specific SDGs, but not in which context documents refer to the SDGs. The information on the relative importance of an SDG, is only derived from the number of documents addressing an SDG and the frequencies of the SDG's underlying keywords and does not take the actual context into account in which these keywords are mentioned. Budget allocations or other commitments (financial, political etc.) towards the implementation of a certain SDG cannot be adequately captured through the automated text mining approach and is a further step in the analysis that requires manual screening and expert judgment. Automating such contextual analyses and commitment tracking will be subject to future improvements of the methodology, as discussed in the concluding chapter (see chapter 4).

Nonetheless, the approach presents a convenient way to analyse large amounts of text in a timely manner with respect to the SDGs semantically addressed inside. It provides a comprehensive picture on how and to which extent a certain text relates to the 2030 Agenda for Sustainable Development. This kind of analysis can be applied at different stages of the policy cycle as support for ex-ante and ex-post expert judgement and evaluation of policy initiatives and actions ⁷.

⁷ [https://www.europarl.europa.eu/thinktank/en/document/EPRS_STU\(2020\)642835](https://www.europarl.europa.eu/thinktank/en/document/EPRS_STU(2020)642835)

3 Results: EU policies and SDGs

As described in the previous chapter, the SDG mapping exercise considers the policy documents available in the EUR-Lex portal for the period 01/12/2019 to 15/01/2022, including both legal acts (namely regulations, decisions, directives, recommendations, declarations) and preparatory documents (communications, staff working documents).

The SDG mapping analysis produces a large amount of data and information to better understand the relationship between EU policies and the 2030 Agenda. Different analytical lenses can be applied to the data in order to extract relevant insights on the semantic links between the policy initiatives and the 2030 Agenda on the goal- and target-level. Main SDGs at stake can be identified along with possible gaps or blind spots where EU policies may not sufficiently address certain SDGs. Cross-cutting policies that address multiple goals and targets at the same time can also be highlighted and analysed to assess potential trends in policy making processes where integrated perspectives are increasingly applied. In combination with simple network analysis techniques in which the SDG links between different policies are analysed, this allows to assess the policy coherence for sustainable development within the EU policy landscape on a broader scale. This chapter provides results of an SDG mapping on the policy initiatives of the current Commission in order to showcase the potential possibilities of the methodology outlined in chapter two. The results are complemented by charts and visualisations along with an analysis of the policy coherence across EU policy initiatives.

3.1 Linking EU policies to the 2030 Agenda, its goals, and targets

The set of documents analysed revealed numerous semantic links with the 2030 Agenda, its goals, and targets. Identified links are either explicit (direct reference to the SDGs inside the text) or implicit (SDG-related keywords inside the text). When comparing legal acts with preparatory documents, the number of direct and indirect references identified tends to be much higher in preparatory documents, presumably due to a higher average character length of preparatory documents and the systemic perspectives applied within compared to legal acts that have legal implications and therefore need to be concise and thematically focused in their underlying texts (see chapter 3.2 on policy coherence for more explanation).

Direct SDG references were found in almost 900 out of 6000 documents analysed with legal acts like the Regulation on establishing the Neighbourhood, Development and International Cooperation Instrument prominently addressing the 2030 Agenda through numerous direct references (Regulation (EU) 2021/947). Among preparatory acts frequently mentioning the SDGs are Staff Working Documents (SWD) focusing on environmental sustainability (e.g. SWD(2022) 3 final - *accompanying the document "Proposal for a Council Recommendation on learning for environmental sustainability"*) or on external actions that are often contextualised with sustainable development agendas like the 2030 Agenda (e.g. SWD (2020) 336 final - *accompanying the document "Annual Report on the implementation of the European Union's instruments for financing external actions in 2019"*).

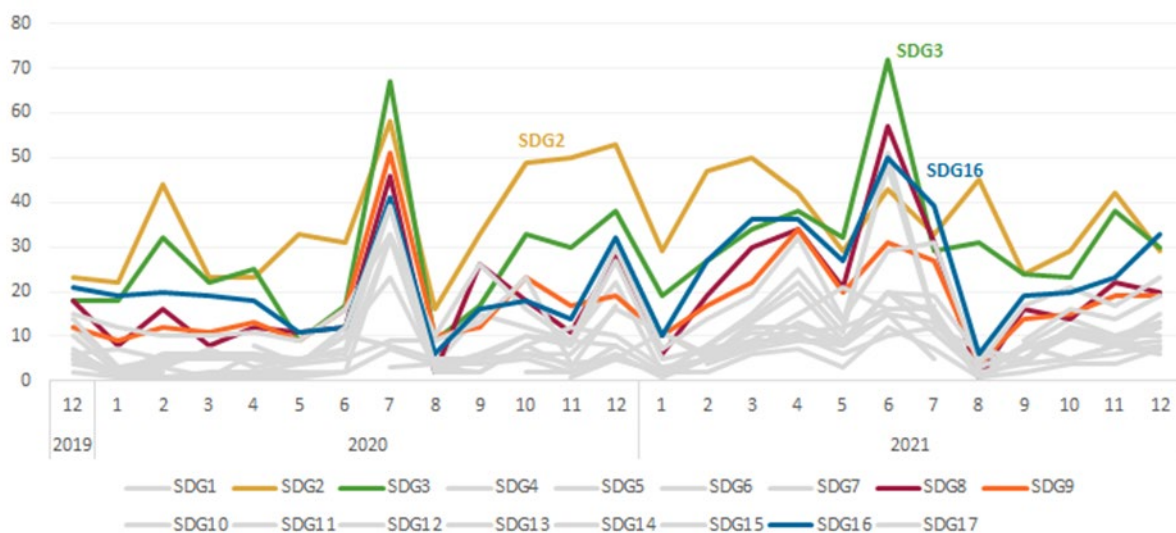
Going beyond explicit links and diving deeper into the documents, keywords related to specific SDG goals and targets are detected to identify implicit links between the documents and the SDGs. When looking at the detected keywords across the entire set of documents, focal points in the EU policy landscapes can be identified. The word cloud below highlights the detected semantic concepts, colour-encoded in the underlying SDG colour. These concepts greatly correspond to the political priorities of the current Commission with topics like energy efficiency, renewable energy, climate change and recycling relating to the Green Deal, while topics like digitalisation, R&D or digital skills can be related to "A Europe fit for the digital age" and many other detected keywords (discrimination, law enforcement, the rule of law, unemployment, fraud) can be linked to the remaining priorities.

Besides the aforementioned differences in the number of identified SDG links between legal acts and preparatory documents, focal points and possible neglected areas inside the SDG framework can be observed in the figure. The strong dominance of SDG 3 on Health and SDG 8 on sustainable economic growth can be explained by the Covid-19 pandemic and the policy measures implemented to counteract the negative impacts that arose from it. The high number of links with SDG 9 on infrastructure, sustainable industrialization and innovation may result from the establishment of the new Framework Programme Horizon Europe and the accompanying acts and documents that complement this important initiative. SDG 16 on peace, justice and strong institutions is another goal with a high number of links identified inside EU policy initiatives, possibly due to the goal's conceptual focus on strong institutions, the rule of law and democracy and the conceptualisation of legal documents providing the baseline for European policy making, having SDG 16 at its core. SDG 2 on Zero Hunger is another example of an SDG with a high number of EU policy initiatives addressing this goal and a particularly high number of legal acts linked to it, potentially due to the new reform of the Common Agricultural Policy (CAP) adopted in 2021 and subsequent legislative and preparatory acts that were put in place (like the rules for support on CAP strategic plans).

Specific trends or political priorities and policy responses to challenges like the Covid-19 pandemic can also be observed when analysing how SDGs are addressed over time. Though the time window for the selected policy initiatives only covers around 2 years, periods of increased policy activities for certain SDGs can be observed in figure 7 below. Such assessments can help in better understanding the dynamics of policy making processes, their drivers, priorities, impacts and challenges.

Figure 7. Trends over the time of legal acts, by goal

Number of legal acts addressing each SDG, by year and month



Source: Authors' elaboration.

Besides highlighting focal points and areas of increased policy activity for certain SDGs, figures 9 and 10 also enable to identify SDGs less prominently addressed through policy initiatives. Goals with a lower number of related policy documents are SDG 6 on water, SDG 5 on gender equality and SDG 14 on marine resources. The low prevalence of SDG 6 could be explained by Europe's relatively good performance on issues related to drinking water quality, water access as well as to sanitation and hygiene which makes this goal less of a priority for political attention and intervention. In its annual monitoring report Eurostat (2021) does not provide an average score for Europe's performance on SDG 6 due to lack of data. However, the indicators related to pollutants in rivers highlight challenges remaining.

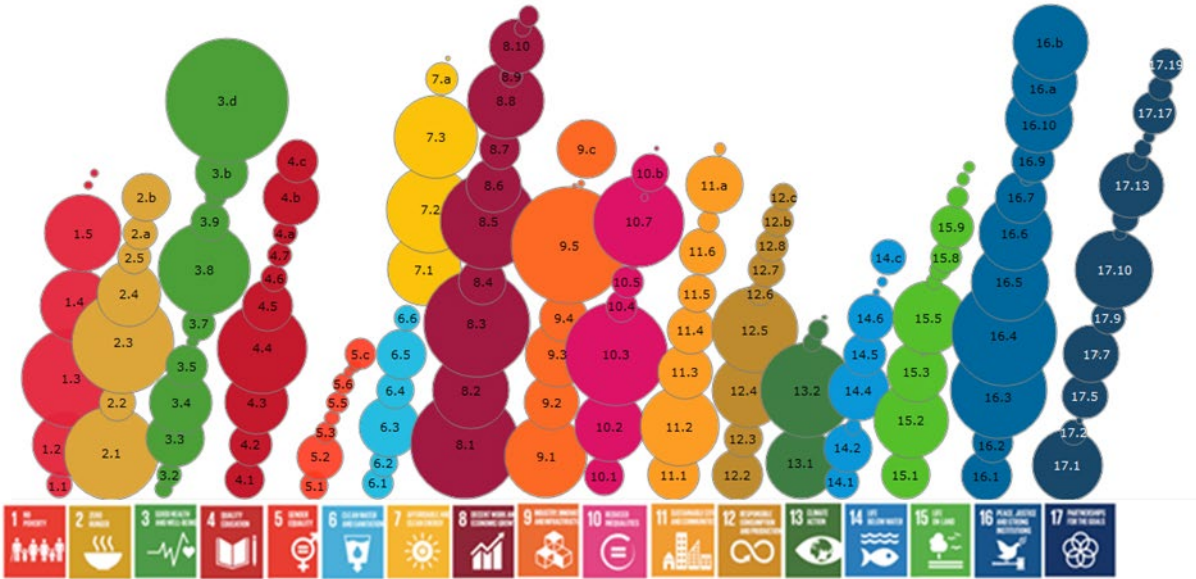
The same applies for SDG 14. This goal also faces conceptual ambiguities related to SDG 15, as both goals tackle biodiversity in different spheres (life on land vs life below water), but main biodiversity actions that apply to both goals are grouped under SDG 15 (e.g. Target 15.9 on ecosystem services, Target 15.7 on wildlife trafficking, Target 15.5 on biodiversity protection, Target 15.8 on tackling invasive alien species or 15.a on

mobilising financial resources for biodiversity conservation). Additionally, as some EU Member States are landlocked and thus, do not focus on SDG 14 and its objectives in their political agendas, the overall importance of SDG 14 in the European policy making processes is further compromised. For SDG 5, several important steps have been taken to foster gender equality, like the EU's Gender Equality Strategy 2020 – 2025 (COM/2020/152 final), the Gender Action Plan III (SWD(2020) 284 final), the EU Strategy on victim's rights (COM/2020/258 final), the proposal for a new Directive to tackle the gender pay gap (COM/2021/93 final) or the Regulation establishing the Citizens, Equality, Rights and Values Programme (REGULATION (EU) 2021/692). Despite these important policy actions, aspects of gender equality do not seem to be coherently considered across the whole set of policy actions, especially when comparing it to other transversal topics like climate change, innovation, skills and education. This lack of semantic consideration combined with the quantitative SDG progress data shown in the Eurostat SDG monitoring report indicates that further political attention towards this goal will be needed in the future.

Though the broad perspective on prominent and less prominent SDGs within the EU policy landscape is a first important step towards understanding how the EU addresses the 2030 Agenda through its political actions, a more granular perspective in which semantically addressed SDG targets are being looked at can help in further contextualising specific links. Out of the whole set of 169 SDG targets, 161 were detected inside the set of EU policy initiatives. The most detected targets tend to correspond to the most detected SDGs, with target 3.d on managing global health risks being the most frequent target detected as a response to the Covid-19 pandemic pervading many political actions taken over the last two years. Other more frequently detected targets highlight the EU's commitment to achieve its EU political priorities, like target 9.5 on enhancing scientific research and fostering innovation which links to "A Europe fit for the digital age". Targets 8.1 on sustainable growth, 8.3 on job creation and 8.5 on decent work and productive employment support "An economy that works for the people" through policy acts like the European Regional Development Fund and the Cohesion Fund. Targets 10.3 on reducing inequalities and 16.3 on promoting the rule of law link to the Commission's priority on "Promoting our European way of life". The "European Green Deal" is fostered by a myriad of policy initiatives that link to various targets under numerous SDGs (most detected targets are: 2.1 on food security, 2.3 on agricultural production, 7.2 on increasing renewable energy shares, 7.3 on energy efficiency, 12.5 on waste management, 13.2 on integrating climate change measures into national policy making, 15.2 on deforestation or 15.5 on halting biodiversity loss). Figure 8 provides a detailed overview on the targets detected across the entire set of documents, including both legal acts and preparatory documents. The size of each bubble corresponds to the total number of policy initiatives linked to the respective target.

Figure 8. Results of the mapping at target level

Number of EU policy documents addressing each target



Source: Authors' elaboration.

In Annex I the detailed description of all the targets detected is provided, with the corresponding number of policy documents linked to both, legal acts and preparatory documents. It is worth noting that the sum of EU

actions by target does not correspond to the total amount at goal level, because every policy can be related to more than one target within the same goal. The information on detected keywords, goals and targets and the underlying data can be further harnessed to analyse the coherence of EU policy initiatives by exploring the connections between different policies, policy objectives and SDGs detected across them.

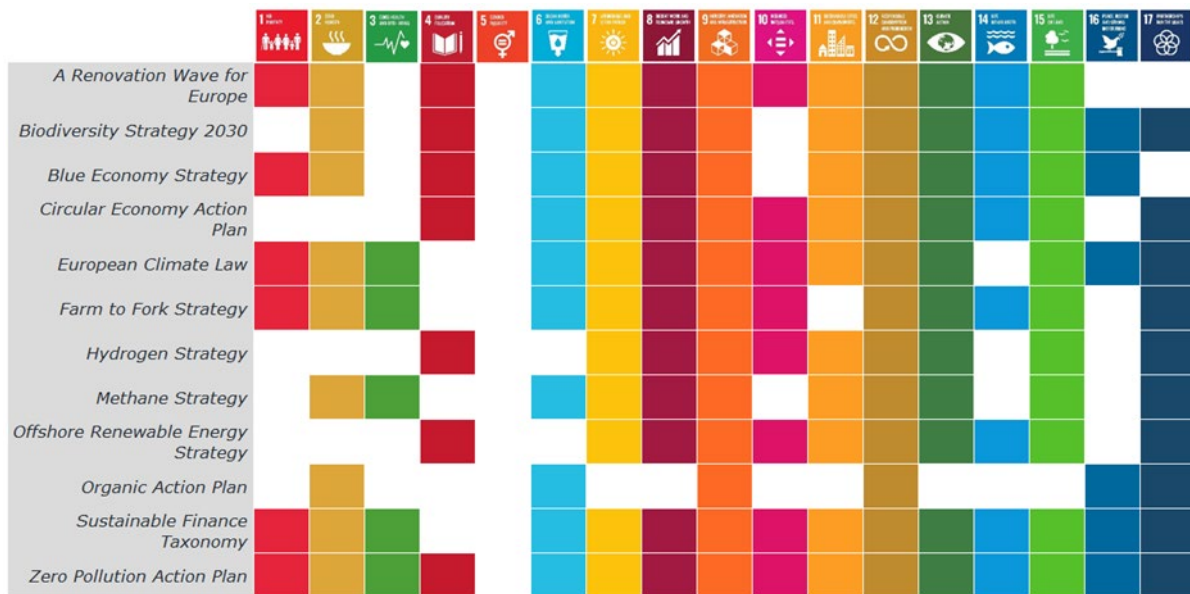
3.2 Towards Policy Coherence: Integrated perspectives on EU Policies

European policy making processes and governance actions are increasingly guided by policy coherence principles. Growing interconnections between different policy areas demand a coherent policy making approach in order to create effective and efficient policies that utilise synergies between policy areas and strive to reduce or avoid conflicts between them. Efforts towards policy coherence in the EU policy context manifest for instance in the EU impact assessment procedures, the better regulation agenda or the numerous roadmap initiatives being put on their way. The six Commission priorities laid out by the von der Leyen Commission, join the ranks of these efforts by advocating for transformational changes in the society, the environment and the economy through an integrated policy approach. It further highlights the gradual shift in paradigms towards policy coherence within the EU policy making processes. The next section will provide some examples of recent policy initiatives and outline their structure and design as well as the way in which they address the 2030 Agenda to highlight the interconnectedness in current policy making processes and how this trend has changed in comparison to previous policy initiatives. The focus will be put on the Commission priorities and their underlying initiatives, exemplifying the Green Deal as an environmental priority and an “Economy that works for the people” as a socioeconomic priority. In a final step, this section explores the interconnectedness of different policies based on targets mutually addressed in them.

The European Green Deal

The European Green Deal strives to tackle environmental and socioeconomic challenges on the way to a climate-neutral Europe that builds on a resource-efficient economy. When looking at the respective Communication concerning the Green Deal (COM(2019) 640 final), there are 48 SDG targets detected in total, corresponding to 15 different SDGs covering various environmental, social and economic aspects. However, this main Communication is merely the preparatory document laying out the main principles and the structure of the Green Deal, while multiple actions are being proposed and put forward to support its implementation. When looking at those specific actions and their links with the Agenda 2030 the bigger picture becomes even more diversified: the European Climate Law (COM/2020/80 final) and the European Climate Pact (COM(2020) 788 final) are not only addressing the targets under SDG 13 on Climate Change, but expand beyond and address topics on clean energy (SDG 7), sustainable transport (SDG 11), biodiversity conservation (SDG 15) as well as sustainable economic growth (SDG 8) and circular economy principles (SDG 12). Other environmental actions concern the New Biodiversity Strategy for 2030 (COM/2020/380 final), the Circular Economy Action Plan (COM/2020/98 final), the Organic Action Plan (COM/2021/141 final/2), the Farm to Fork Strategy (COM/2020/381 final), the Hydrogen Strategy (COM/2020/301 final), the Blue economy Strategy (COM/2021/240 final), the Methane Strategy (COM(2020) 663 final), the Zero Pollution Action Plan (COM/2021/400 final) and the Sustainable Finance Taxonomy (Regulation (EU) 2020/852) and the SDG Mapping results for those actions indicate links with numerous goals and targets of the 2030 Agenda. Though those actions predominantly address the environmental SDGs, multiple links were also detected with social and economic SDGs (however, one should note that none of the actions could be linked to SDG 5 on Gender Equality through our methodological approach). The table below lists a subset of selected actions grouped under the Green Deal and illustrates the different SDGs semantically detected in their core documents. Even though these are actions specifically designed to tackle certain challenges, they were designed in a systemic manner, considering multiple SDGs through an integrated perspective. The disentanglement of these interconnections between different actions and thematic policy areas is crucial for understanding the coherence of the Green Deal as overarching framework.

Figure 9. SDG mapping results for a subset of actions for the priority “A European Green Deal”



Source: Authors' elaboration.

The Biodiversity Strategy – Old vs. New

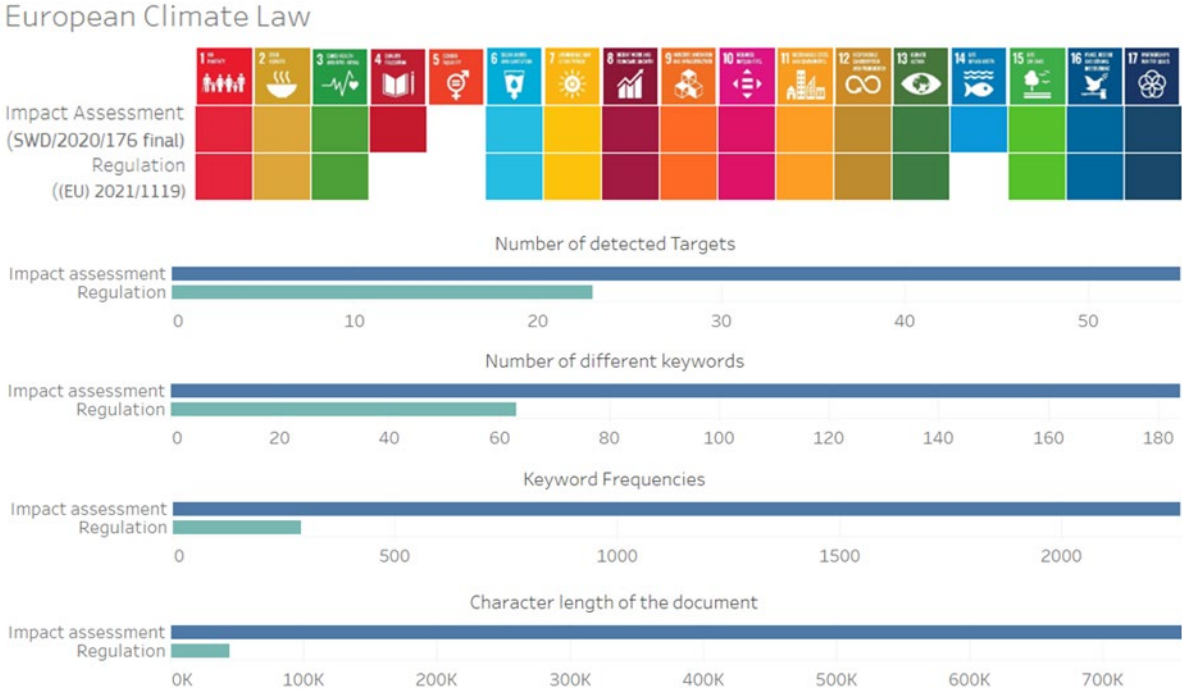
Another way to capture the trend in EU policy making processes towards more policy coherence is to look at the differences between older policy initiatives and their updated version. When comparing the Biodiversity Strategy 2020 (COM/2011/0244 final) with the Biodiversity Strategy 2030 (COM/2020/380 final) with regard to their SDGs detected, clear differences become apparent. While in the first version of the strategy there were around 60 different keywords detected with a total count of 174, corresponding to 10 different goals and 24 different targets, the updated version of the strategy had 158 different keywords detected with a count of 283, corresponding to 13 different goals and 54 different targets. Though the previous strategy was published in 2011, 4 years before the actual adoption of the 2030 Agenda, the comparison of detected SDGs is still useful for comparing the way in which policy documents addressed specific topics in the past and in the present as the underlying keywords represent semantic concepts long-established and the results indicate that present policy documents like the new Biodiversity Strategy apply more integrated perspectives and cover a broader range of topics in a more comprehensive manner, ultimately also contributing to more coherent policy making. However, it needs to be noted that the new biodiversity strategy is also a significantly longer document compared to the old strategy (12800 words vs. 7200 words), which increases the chance of detecting keywords in the text, but the fact that this document is longer may already be an indication for changing trends in policy design processes.

Conceptual differences in EU Policy Document types

Different document lengths and their impacts on the detection of SDGs also come into play when comparing legal and preparatory documents. Preparatory documents tend to be almost twice as long as legal documents on average, eventually leading to a higher number of detected targets (14 vs. 3 on average), higher frequencies of detected keywords (143 vs 25 on average) and a higher number of distinct keywords detected (29 vs 4 on average) per document. The higher number of distinct keywords detected, and their corresponding frequencies cannot be solely explained by the longer document lengths. One reason is the differences in the conceptual design of certain legal and preparatory document types. Impact assessments preceding respective legislative acts, need to consider all potential impacts in the social, economic, and environmental dimension and thus, a greater range of different SDGs should be detected in them. In a similar way, other preparatory document types like Communications (e.g. Action Plans) are conceptually also more comprehensive than the corresponding legislative acts, providing additional information on the background, impacts or previous analyses. Conversely, the language in legislative acts bears legal implications and thus, needs to be concise and clearly defined. Differences in the conceptualisation of certain document types and their implications for SDGs detected in their underlying documents can be observed when looking at specific policy examples like the European Climate Law (Regulation (EU) 2021/1119). In preparation of this Directive, an Impact

Assessment was carried out (SWD/2020/176 final) with the goal to analyse and address environmental, economic, and social impacts that may arise from this policy action. The mapping results of the Impact Assessment’s underlying document shows the great range of SDGs covered in the text. As the document is also significantly longer than the actual regulation, the number of detected goals and targets, keywords and their frequencies is much higher (see figure below).

Figure 10. SDG mapping results for two compared documents



Source: Authors’ elaboration.

Despite these significant differences in detections, the results on the goal-level still illustrate how the integrated perspective in the impact assessment perpetuates in the final legal text of the Regulation and the integrated perspective in which the majority of goals is considered, persists. Such in-depth analyses of specific policy actions demonstrate the capability of the SDG mapping approach to detect small nuances and changes in policy making processes with a high level of granularity, as well as the potential for capturing the systemic perspective utilised in different stages of the policy making process.

An economy that works for people

Another Commission priority promoting European policy coherence efforts is “an economy that works for people” which has a stronger socio-economic focus than the Green Deal priority. The achievement of this priority has been particularly severely affected by the Covid-19 pandemic. Several ad-hoc actions were implemented to cope with the short- and long-term impacts of the pandemic, like the “temporary Support to mitigate Unemployment Risks in an Emergency” (SURE) instrument, financed through the issuance of social bonds regulated in the Social Bond Framework. Despite those ad-hoc responses to the socio-economic impacts of the pandemic, multiple initiatives are on its way to implement this priority. Being part of the Commission’s Fair Economy Package, the EU Action Plan for a Social Economy will be proposed within the fourth quarter of 2021, aiming to facilitate social investments and support social enterprises, start-ups, and other actors in the social economy to create, innovate and scale-up jobs in the sector.

Other actions already put forward are for instance the Economic Policy Coordination 2021 (COM(2021) 500 final), InvestEU (Regulation (EU) 2015/1017), Youth Employment Support (COM(2020) 276 final), the Annual Sustainable Growth Strategy (COM(2019) 650 final – though it is also a deliverable under the Green Deal, it is also highly relevant for this priority), the European Pillar of Social Rights Action Plan (COM/2021/102 final), the European Skills Agenda (COM/2020/274 final) and the Communication on “A strong social Europe for Just Transitions”. While each one focuses on several socio-economic aspects, the table below shows how many of

these actions also refer to environmentally related SDGs in their underlying documents. Compared to the selected Green Deal initiatives, SDG 5 on Gender Equality is addressed under numerous initiatives.

Figure 11. SDG mapping results for a subset of actions for the priority ‘An economy that works for people’



Source: Authors' elaboration.

The examples outlined above prove how the European Commission strives to apply a holistic, integrated perspective along all stages of its policy making process, being not only present in the overarching policy framework (Commission priorities), but also in the individual policy initiatives. Though the conceptual differences between certain policy document types may lead to significant differences in the detection of keywords and their corresponding targets and goals (e.g. impact assessment vs. Legislative document), the systemic approach through which multiple goals are addressed inside the same documents, is preserved across policy initiatives.

An SDG network to understand policy coherence?

The perspective on policy coherence can also be inversed by looking at the bigger picture of detected goals and targets across the whole set of policy documents rather than looking at how individual policy initiatives address SDGs inside a specific overarching policy framework. Identifying connections between the SDGs based on documents that mutually address them in the text harnesses the benefits of coherently designed policies and can inform future policy making processes by highlighting those interlinkages. Such connections can be illustrated as networks of nodes and edges, where nodes represent the respective SDGs and edges are the links between those SDGs based on the number of policy documents mutually addressing SDG pairs and their underlying targets. The figure below illustrates the complexity of such a network in the case of the SDG framework as all the 17 goals are interconnected with each other. This effect is further amplified by the aforementioned policy coherence principles embedded in the EU policy making processes and their corresponding policy documents. Furthermore, the network graph below shows a bias in its edge thicknesses, as targets and goals that were more often detected inside documents are also more likely to be addressed together across the whole set of documents.

Figure 12. Network diagram of SDG interconnections among policies



Source: Authors' elaboration.

Though this network graph effectively showcases the coherence of policies, the plethora of interconnections makes it hard to navigate through them and extract valuable insights on potential interlinkages between certain SDGs. For this objective, it can be useful to reduce the amount of information in the data behind, for instance by retaining only SDG interconnections with the highest number of overlapping policies for each SDG. Through this approach, possible links between SDGs with lower detections like SDG 5 on Gender Equality and other SDGs can be more easily identified, as those connections would otherwise be suppressed by goals with a high number of detections. In the example of SDG 5, its most significant links were detected with SDG 10 on inequalities, SDG 16 on peace, justice and strong Institutions as well as with SDG 8 on sustainable economic growth. While SDG 10 is thematically overlapping with gender equality objectives, SDG 16 strives to provide the institutional and legal base for such transformations, whereas SDG 8 specifically targets gender inequalities inside the employment sector through its target 8.5 on “Full employment and decent work with equal pay”.

A more prevalent interlinkage in the network can be found between SDG 1 on Poverty Eradication and SDG 8. Despite the contextual dependencies between these goals (without sustainable economic activities poverty is difficult to combat), EU policy actions like the Decisions on macro-financial assistance to countries in need usually address both SDGs in an integrated manner and are contributing to the dominance of this link in the network.

The link between SDG 8 and SDG 3 on Health is another strong connection in the network, mainly resulting from the high number of policy initiatives tackling the pandemic and its subsequent recovery process.

The current Commission’s priority on fostering digitalisation and innovation also trickles down into the network, showing strong connection between SDG 9 on innovation, sustainable industrialisation and resilient infrastructure and many other SDGs like SDG 8 (strong connection between economic development, infrastructure development, industrialisation and innovation) or SDG 13 on tackling climate change where innovation and sustainable industrialisation play a vital role for achieving this goal. Due to its high detections, SDG 13 also has a dominant position in the network, strongly linking to several of the aforementioned goals.

While such network analysis and visualisations can help in better understanding the possible interlinkages between certain SDGs and provide useful insights in support of their implementation process, the conclusions should be drawn carefully when interpreting these networks, as methodological choices made during the initial data analysis may impact the outcomes providing the baseline for these networks. Therefore, contextualising those findings with the data and EU policy actions behind is crucial for understanding the coherence of the underlying policies and how they potentially harness SDG interlinkages inside the 2030 Agenda.

4 Conclusions and next steps

The analysis of the current Commission's policy initiatives revealed a vast number of semantic links with the SDG framework, underlining the ambition stressed by Commission President Mrs. Von der Leyen to mainstream the SDGs into EU policy making processes. The general overview of detected goals and targets also reflects the focus on the proposed policy priorities as well as attempts to tackle specific challenges (e.g. Covid-19 and the recovery process) over the last two years.

The push for the Commission's Green Deal priority has been fostered by multiple policy initiatives that address environmental and socioeconomic aspects in an integrated manner, ultimately leading to a strong prevalence of SDG 13 on Climate Change in the SDG framework (especially in terms of keywords detected across all policy documents). The pandemic and its corresponding recovery efforts are also well reflected in the results, with SDG 3 on Health and SDG 8 on decent economic growth leading the list of detected goals as well as of detected targets.

The strong detection of SDG 9 (particularly target 9.5) also shows the future-oriented perspective of the Commission and their attempts to harness research and innovation to foster the transformational changes envisioned within its political priorities.

On the contrary, the mapping also revealed potential gaps, where EU policies do not prominently address certain SDGs. One example is SDG 5 on gender equality, where it became clear that besides some policy initiatives specifically addressing this goal, gender-related aspects in general are not adequately considered across EU policies, e.g. within overarching policy frameworks like the Green Deal and its subsequent policy actions. Another example can be found in SDG 6 on water access, water quality and sanitary standards. As the EU has already made substantial progress towards this goal and its underlying targets (apart from negative trends in nitrogen concentration in groundwater due to increased agricultural activity), the political priorities outline different focal points with respect to the targeted SDGs. Similarly, SDG 14 on life below water is not of universal concern to all the member states (especially landlocked countries) and may thus, not be targeted as extensively through EU actions as other environmentally related SDGs (SDG 15 as the Goal with the main biodiversity conservation objectives or SDG 13 on Climate Change). It is important to analyse these potential gaps and consider them respectively in future policy making processes.

Besides the identification of links between EU policies and the Agenda2030, the analysis also allowed to further explore these links by highlighting specific policy initiatives that were particularly relevant to selected SDGs (e.g. Horizon Europe Programme for SDG 9 and target 9.5, the EU4Health Programme for SDG 3 and target 3.d or the European Regional Development Fund and Cohesion Fund for SDG 8 and target 8.1). Individual assessments of EU policy initiatives can help in identifying actions with the greatest potential to support the implementations of the SDGs.

The present SDG policy mapping does not only contribute to a better understanding of how EU policy initiatives relate to the Agenda2030 and its goals and targets and what specific actions address which specific SDGs to what extent, but it also allows to analyse the policy making processes in the context of their policy coherence capabilities. As outlined above, the current Commission and the overarching framework of political priorities strongly emphasise an integrated approach for designing and implementing new policy initiatives. The results proved that the EU strives to apply a holistic perspective to their policy making processes by covering a broad range of SDGs within different stages of the policy cycle (from problem definition to policy proposal to impact assessment to legal act to evaluation reports). Looking at the coherence between different policy initiatives allows to better grasp the way in which policies are conceptualised and implemented and how they are interconnected with each other. Fostering policy coherence is crucial for designing efficient policies that reinforce synergies with other initiatives and avoid potential trade-offs.

Though the semantic SDG mapping approach does not join the ranks of new AI and ML approaches to solve complex classification problems by utilising different machine learning algorithms, it presents a robust and transparent method to automatically detect relevant SDGs and targets in a timely manner, that can be applied to any type of document without risking mispredictions that do not necessarily correspond to the document context (only detects what is in the text and does not make predictions on the numerical representation of a text like in AI, ML methods as explained in chapter 2).

However, technical, conceptual and contextual challenges and limitations exist and need to be addressed in future developments and refinements of the tool. The following section will briefly discuss them.

4.1 Limitations of the approach

Misleading context

Though the keyword approach provides a robust method to identify certain topics in the text with regard to the SDGs, the context in which these topics are addressed is harder to capture and requires a more qualitative analysis that complements the automated steps of the semantic mapping process. Without qualitative assessments, the highlighted relation between a document and the SDGs can be misleading. One such example can be found with the Regulation (EU) 2019/2242 on “*Specifying the technical items of data sets, establishing the technical formats and specifying the detailed arrangements and content of the quality reports on the organisation of a sample survey in the income and living conditions*”. Though the regulation focuses on the structure of datasets and a survey and should thus be mainly linked to 17.18 or 17.19 that aim to enhance statistical capacities (even though mostly in the context of developing countries), the automated mapping rather links it to the topics included in the survey which is why Targets 4.1, 4.3 (detected keywords primary, secondary, tertiary education) and 8.5 (detected keywords unemployment) are the main targets identified for this Regulation. Such misleading contexts are difficult to spot, especially across a large data set of documents like in the present analysis as they require qualitative check-ups of the results in order to contextualise them with the document texts.

Complex concepts

Certain targets address complex or vague concepts that can be difficult to capture through a semantic keyword matching process. Defining appropriate keywords for conceptually vague targets like target 10.6 on “*Ensuring enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions*” can be challenging as topics like participation can be semantically described through many different keywords. Additionally, 10.6 focuses on developing countries in particular. Means of Implementation (MOI) targets that address the developing countries context are particularly difficult to detect as their underlying keywords need to capture more than one concept (first concept = developing countries, second concept = specific topic of the target).

Another example of complex targets whose underlying context and concept can be hard to detect is target 17.14 on “*enhancing policy coherence for sustainable development*”. Different aspects comprising policy coherence (like long-term vision, political commitment and leadership, stakeholder engagement and management, policy integration, impact assessment, monitoring, evaluation and reporting, horizontal government coordination) need to be semantically captured in the context of policy coherence and governance, ultimately leading to complex and specific keywords that are difficult to identify in the text. Future developments and refinements of the semantic SDG mapping approach should consider different text mining and natural language processing techniques that extend beyond the current keyword matching approach, for instance algorithms like the “Longest Common Subsequence” in order to improve the detection of certain targets and the topics and concepts they address. AI methods and deep learning techniques in particular can further complement those efforts, especially in the field of complex topic modelling and semantic concept extraction.

Comparison between documents

Is the Hydrogen Strategy more strongly linked to SDG 7 than the Methane Strategy? Is the Circular Economy Action Plan more contributing to SDG 12 and its Waste Management targets than the Zero Pollution Action Plan? Has the new reform of the Common Agricultural Policy a greater impact on transforming our food systems than the Farm-to-Fork Strategy? Such questions can be difficult to answer when solely looking at the mapping results as keyword detections and their frequencies may have a different meaning in different document types or in documents with different lengths. Comparisons between policy initiatives and their documents are sensitive and highlight the need to contextualise mapping outputs in a qualitative manner, requiring a more in-depth analysis of the document structure, the outlined objectives and their expected impacts. While the mapping results can provide useful insights to better understand the connection between policy actions and the SDG framework, conclusions need to be drawn carefully, bearing in mind what the results are: counts of SDG-related keywords detected in a document text that simply show the prevalence of those keywords and their corresponding SDG goals and targets without considering specific contexts in which the SDGs are mentioned or if a text states a tangible commitment towards the SDGs and their implementation.

4.2 Next Steps

Future developments of the tool will attempt to address the technical limitations discussed above and alternative keyword matching algorithms (e.g. Longest common subsequence) will be explored, tested and potentially deployed in order to further increase the robustness of the mapping and the reliability of its outputs. Engagement with relevant SDG experts can help to improve the keyword base in order to mitigate the possibility of false positives or negatives when scanning a text.

With the development of the SDG Mapper tool - the automated SDG mapping approach presented here has been translated into a web-based application where documents are mapped on the fly, offering various applications for different stakeholder groups who want to engage with the SDGs (see box 1).

Box 1. SDG Mapper tool

The SDG Mapper is a web-based application on the KnowSDGs platform (<https://knowsdgs.jrc.ec.europa.eu>) that allows users to map any document with the SDGs on both – goal- and target-level in real time in order to identify the semantic links between documents and the 2030 Agenda with its SDGs. The tool capitalises on the methodology presented in this report and provides additional features such as different data visualisations and a final summary report. It also provides information on the detected goals' and targets' underlying indicators as well as an SDG reference tracker that lists the direct references to the 2030 Agenda detected in the uploaded documents. Mapping results can be downloaded in table format for further in-depth data analysis and interpretation. The keyword-based approach enables the assessment of the semantic prevalence of certain SDGs. Detected keywords and their underlying frequencies allow for a more granular picture on detected goals and targets. Ultimately, the tool shall help users in contextualising their work with the SDGs and contribute to a better understanding of the 2030 Agenda and its Goals, targets, and indicators. In the future the tool will feature an API (in Beta) to facilitate the mapping of larger texts and multiple documents as well as a multilingual feature (under development) to map documents also in other languages (e.g. French, Italian, Spanish, German and other EU languages) with the SDGs.

However, users need to be wary of the underlying methodology in order to appropriately contextualise the mapping outputs and avoid the misuse of results for “SDG Greenwashing” purposes. As pointed out before, the tool detects SDG specific keywords in any kind of documents, but neither the context nor the type of commitment towards these SDGs are captured. Future developments could seek to link the semantic mapping outputs with budget allocations or other commitments stated in the text. Though this would tremendously strengthen the contextualisation of the mapping results, it is also a very sensitive and challenging task, where the reliability of the outcomes is becoming even more essential for the overall robustness of the results.

To further increase the potential applicability of the approach and the SDG Mapper as a tool, the SDG specific keywords is being translated in other languages (starting from French, Spanish, German, and Italian) to support also national, regional and local efforts to contextualise stakeholder's activities with the Agenda2030 and its SDGs.

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List of abbreviations and definitions

AI	Artificial Intelligence
EC	European Commission
EU	European Union
IEEP	Institute for European Environmental Policy
JOIN	Joint Communication
JRC	Joint Research Centre
ML	Machine Learning
MOI	Means of Implementation
OECD	Organisation for Economic Co-operation and Development
PCSD	Policy Coherence for Sustainable Development
SDGs	Sustainable Development Goals
SDSN	Sustainable Development Solutions Network
SWD	Staff Working Document
UN	United Nations

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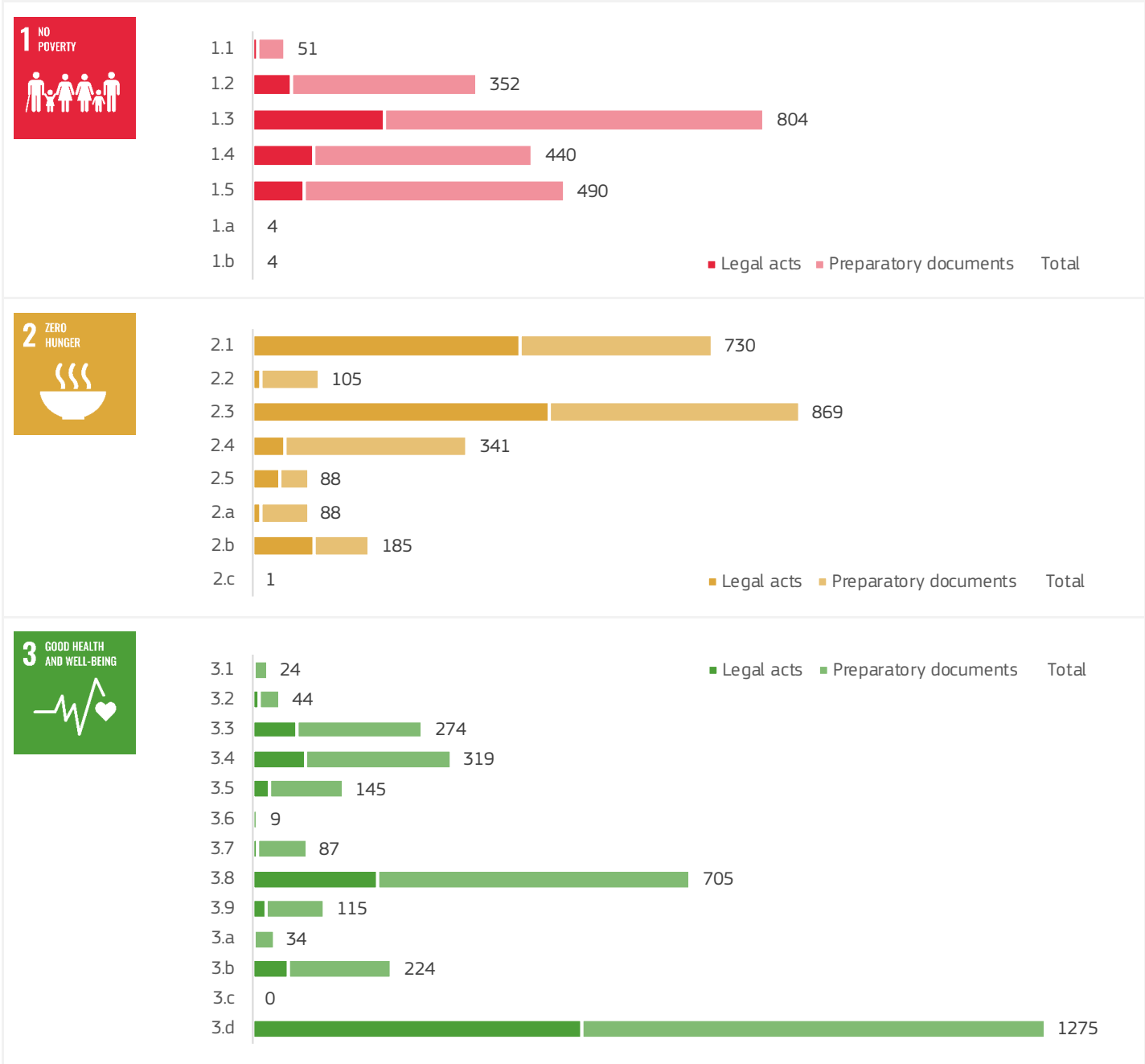
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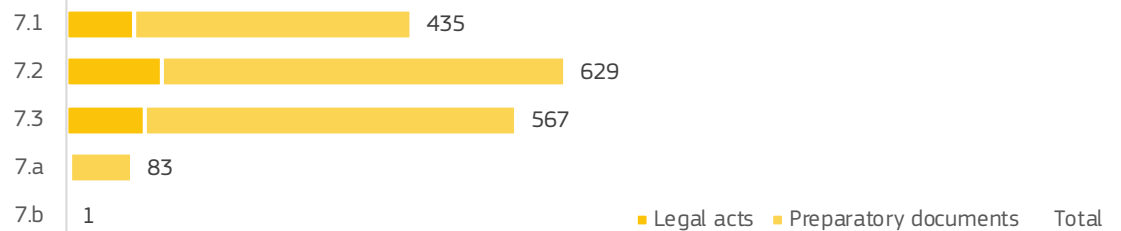
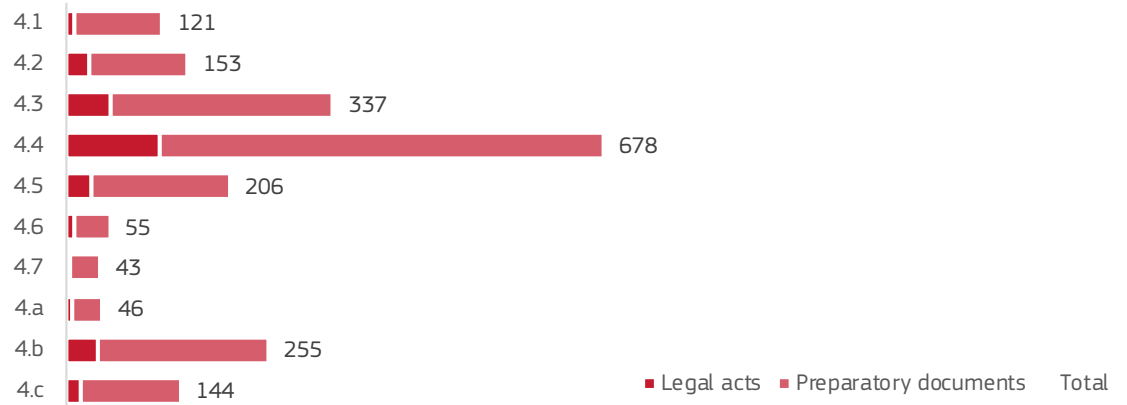
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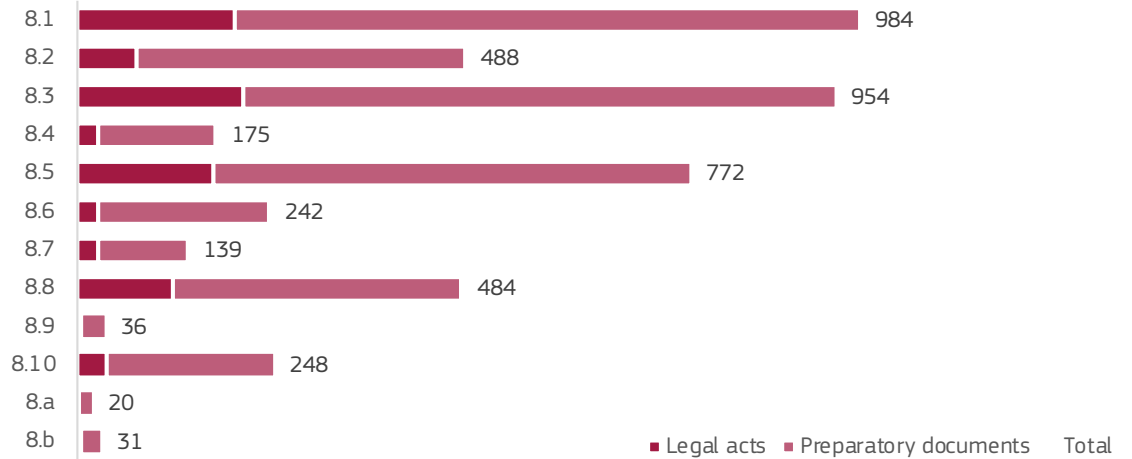
Figure A1. Results at target level, by goal and type of document

Number of EU policy documents addressing each target (legal acts and preparatory documents)

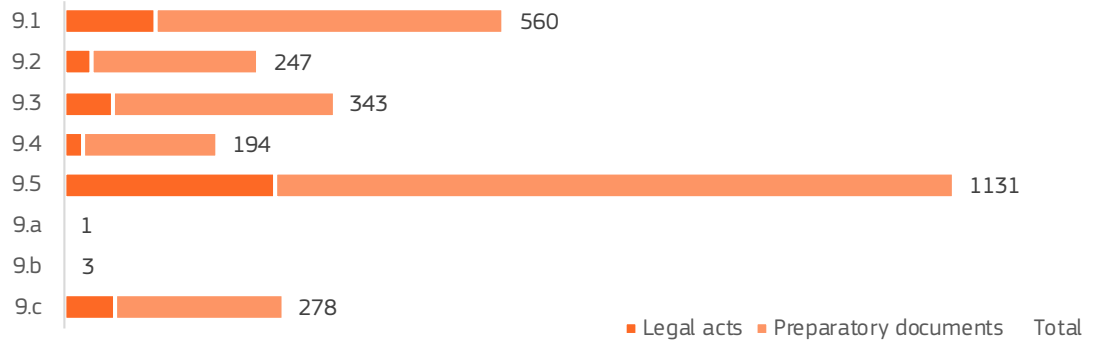




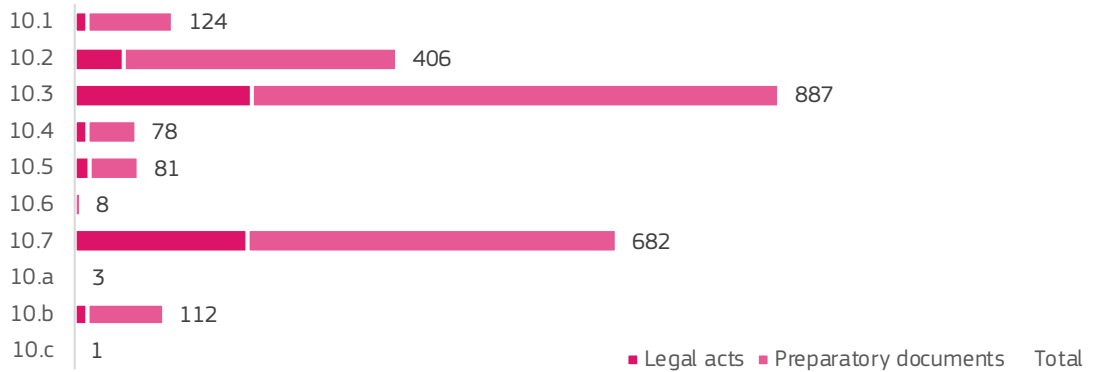
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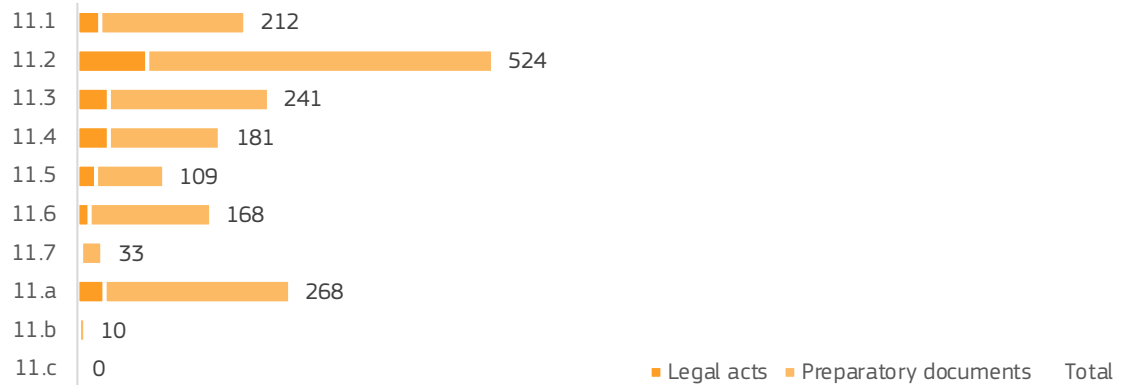
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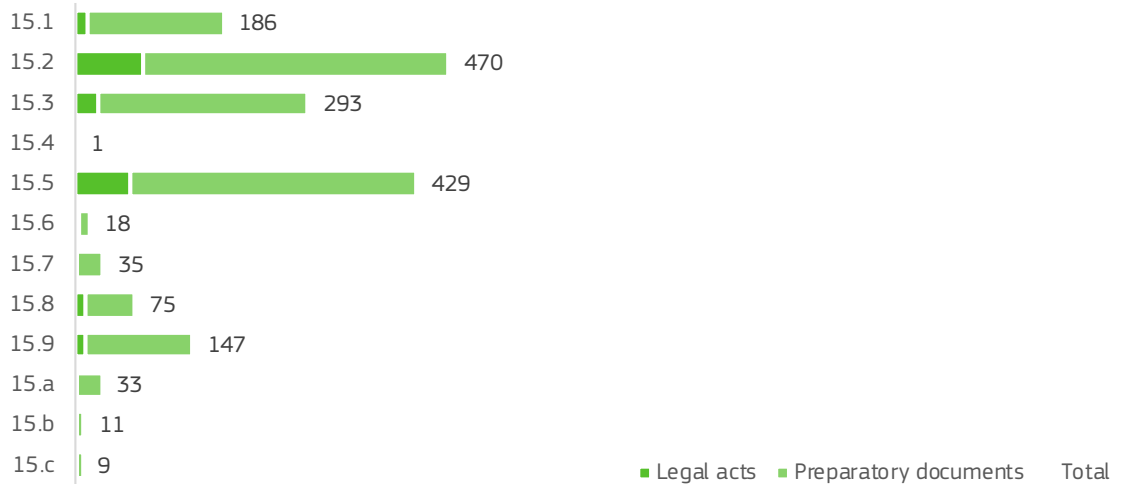
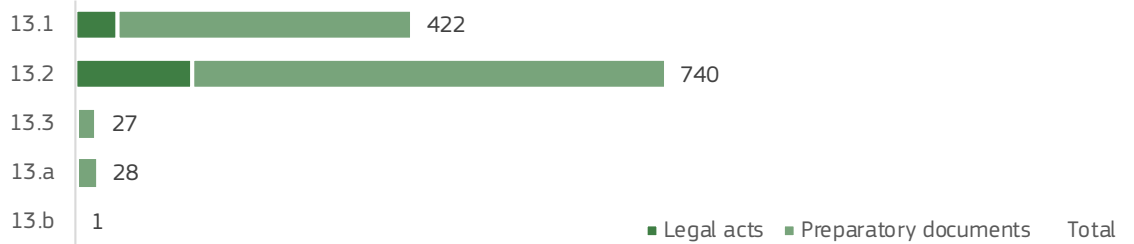
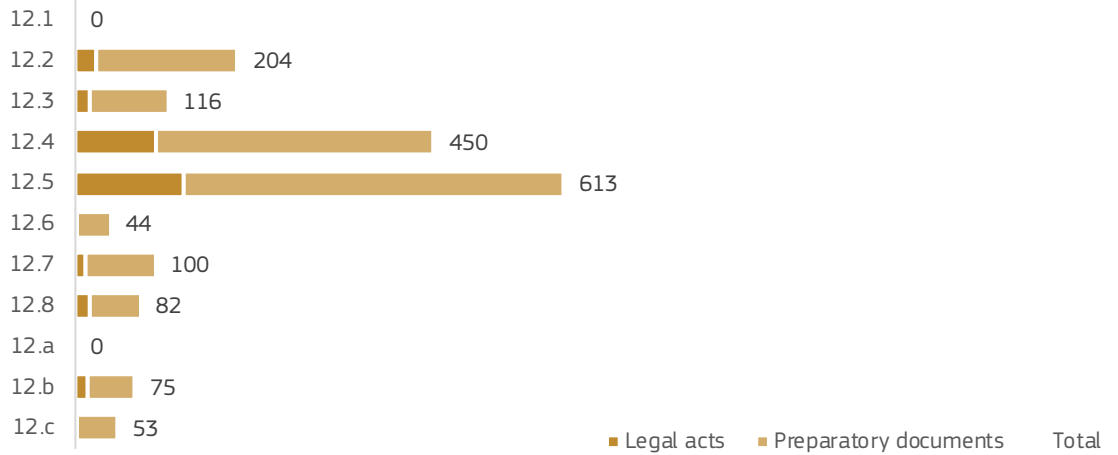


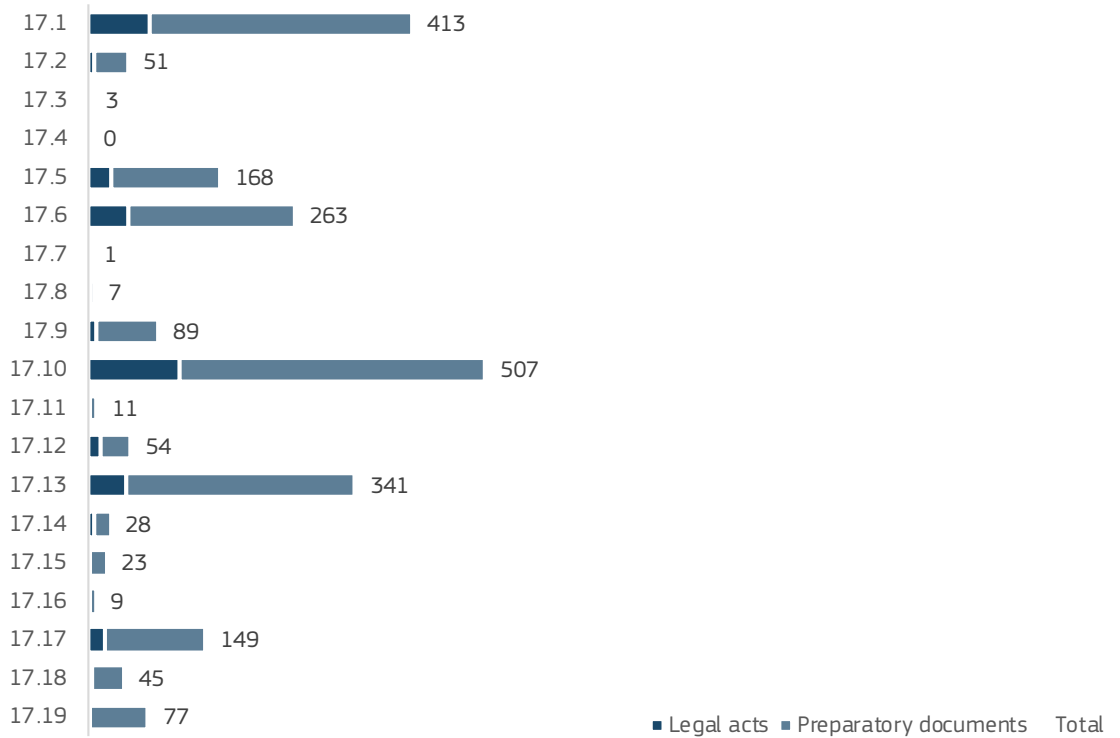
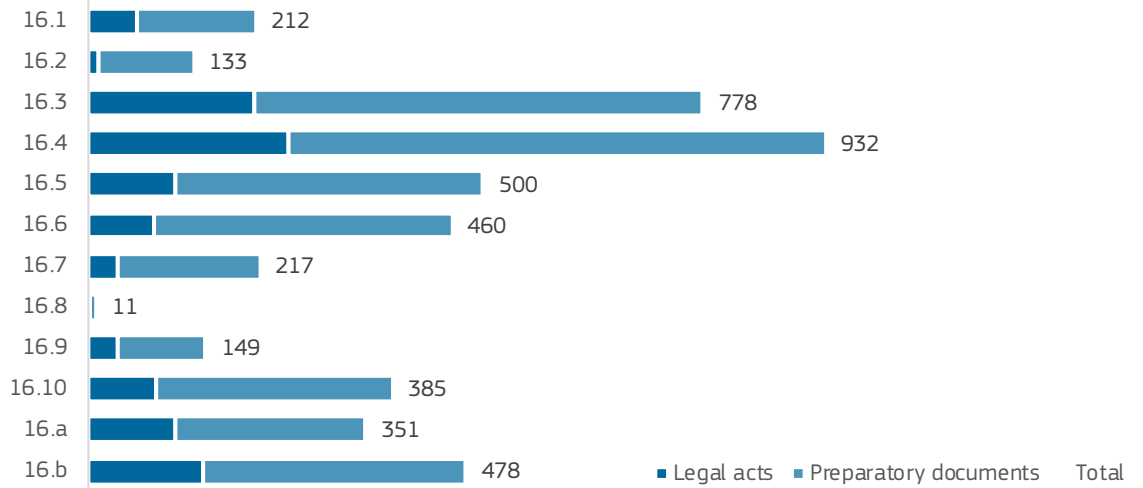
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11 SUSTAINABLE CITIES AND COMMUNITIES















Source: Authors' elaboration.



Table A1. List of UN targets with associated number of policy documents (legal acts and preparatory documents)



 1 NO POVERTY GOAL 1: NO POVERTY End poverty in all its forms everywhere		Legal acts	Preparatory documents	Total
1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day		8	43	51
1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions		61	291	352
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable		207	597	804
1.4 By 2030 ensure that all men and women, particularly the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership, and control over land and other forms of property, inheritance, natural resources, appropriate new technology, and financial services including microfinance		96	344	440
1.5 By 2030 build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters		81	409	490
1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation to provide adequate and predictable means for developing countries, in particular LDCs, to implement programmes and policies to end poverty in all its dimensions		1	3	4
1.b Create sound policy frameworks, at national, regional and international levels, based on pro-poor and gender-sensitive development strategies to support accelerated investments in poverty eradication actions		1	3	4
 2 ZERO HUNGER GOAL 2: ZERO HUNGER End hunger, achieve food security and improved nutrition and promote sustainable agriculture				
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round		426	304	730
2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons		12	93	105
2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment		470	399	869
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality		50	291	341
2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.		44	44	88
2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries		14	74	88
2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round.		97	88	185
2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.		-	1	1



3 GOOD HEALTH AND WELL-BEING  GOAL 3: GOOD HEALTH AND WELL-BEING Ensure healthy lives and promote well-being for all at all ages			
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	1	23	24
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	11	33	44
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	72	202	274
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	84	235	319
3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	27	118	145
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	-	9	9
3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes	9	78	87
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	202	503	705
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	22	93	115
3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate	3	31	34
3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all	58	166	224
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	-	-	-
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	529	746	1275
4 QUALITY EDUCATION  GOAL 4: QUALITY EDUCATION Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all			
4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	11	110	121
4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education	28	125	153
4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university	57	280	337
4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	117	561	678
4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations	33	173	206
4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy	11	44	55
4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity	6	37	43



and of culture's contribution to sustainable development			
4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all	7	39	46
4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries	39	216	255
4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States	19	125	144
5 GENDER EQUALITY  GOAL 5: GENDER EQUALITY Achieve gender equality and empower all women and girls			
5.1 End all forms of discrimination against all women and girls everywhere	7	53	60
5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation	42	129	171
5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation	3	32	35
5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	1	16	17
5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	1	33	34
5.6 Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences	-	32	32
5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws	-	6	6
5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women	-	10	10
5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels	18	60	78
6 CLEAN WATER AND SANITATION  GOAL 6: CLEAN WATER AND SANITATION Ensure availability and sustainable management of water and sanitation for all			
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	11	67	78
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	12	48	60
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	48	251	299
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	19	96	115
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	34	166	200
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	5	46	51
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	-	-	-
6.b Support and strengthen the participation of local communities in improving water and	-	-	-


sanitation management			
7 AFFORDABLE AND CLEAN ENERGY  GOAL 7: AFFORDABLE AND CLEAN ENERGY Ensure access to affordable, reliable, sustainable and modern energy for all			
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	86	349	435
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	120	509	629
7.3 By 2030, double the global rate of improvement in energy efficiency	98	469	567
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	5	78	83
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	1	-	1
8 DECENT WORK AND ECONOMIC GROWTH  GOAL 8: DECENT WORK AND ECONOMIC GROWTH Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all			
8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	199	785	984
8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	74	414	488
8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	208	746	954
8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead	26	149	175
8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	172	600	772
8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	27	215	242
8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms	27	112	139
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	120	364	484
8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	4	32	36
8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	38	210	248
8.a Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries	1	19	20
8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization	5	26	31

 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE GOAL 9: INDUSTRY, INNOVATION AND INFRASTRUCTURE Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation			
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	117	443	560
9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries	35	212	247
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets	63	280	343
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	24	170	194
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	269	862	1131
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States	-	1	1
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	1	2	3
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	64	214	278
 10 REDUCED INEQUALITIES GOAL 10: REDUCED INEQUALITIES Reduce inequality within and among countries			
10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	15	109	124
10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	63	343	406
10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard	224	663	887
10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	16	62	78
10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations	18	63	81
10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions	-	8	8
10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies	217	465	682
10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements	2	1	3
10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes	17	95	112
10.c By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent	-	1	1

 GOAL 11: SUSTAINABLE CITIES AND COMMUNITIES Make cities and human settlements inclusive, safe, resilient and sustainable			
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	28	184	212
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	89	435	524
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	41	200	241
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	40	141	181
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	24	85	109
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	16	152	168
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	5	28	33
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	35	233	268
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels	1	9	10
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	-	-	-
 GOAL 12: RESPONSIBLE CONSUMPTION AND PRODUCTION Ensure sustainable consumption and production patterns			
12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	-	-	-
12.2 By 2030, achieve the sustainable management and efficient use of natural resources	25	179	204
12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	18	98	116
12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	102	348	450
12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	135	478	613
12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	1	43	44
12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities	12	88	100
12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	17	65	82
12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	-	-	-
12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	15	60	75
12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect	1	52	53

their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities			
<div style="display: flex; align-items: center;"> <div style="text-align: center; width: 10%;"> 13 CLIMATE ACTION </div> <div style="margin-left: 10px;"> GOAL 13: CLIMATE ACTION Take urgent action to combat climate change and its impacts </div> </div>			
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	53	369	422
13.2 Integrate climate change measures into national policies, strategies and planning	147	593	740
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	1	26	27
13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	2	26	28
13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	-	1	1
<div style="display: flex; align-items: center;"> <div style="text-align: center; width: 10%;"> 14 LIFE BELOW WATER </div> <div style="margin-left: 10px;"> GOAL 14: LIFE BELOW WATER Conserve and sustainably use the oceans, seas and marine resources for sustainable development </div> </div>			
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14	82	96
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	43	149	192
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	3	17	20
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	139	171	310
14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	39	108	147
14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation	51	118	169
14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	-	-	-
14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	-	3	3
14.b Provide access for small-scale artisanal fishers to marine resources and markets	1	6	7
14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	25	75	100

 GOAL 15: LIFE ON LAND Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss			
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	16	170	186
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	85	385	470
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	29	264	293
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	-	1	1
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	69	360	429
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed	4	14	18
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	3	32	35
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	13	62	75
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	12	135	147
15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	1	32	33
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	1	10	11
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	2	7	9
 GOAL 16: PEACE, JUSTICE AND STRONG INSTITUTIONS Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels			
16.1 Significantly reduce all forms of violence and related death rates everywhere	62	150	212
16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children	14	119	133
16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	211	567	778
16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime	254	678	932
16.5 Substantially reduce corruption and bribery in all their forms	110	390	500
16.6 Develop effective, accountable and transparent institutions at all levels	83	377	460
16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	36	181	217
16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance	2	9	11

16.9 By 2030, provide legal identity for all, including birth registration	37	112	149
16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	86	299	385
16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime	110	241	351
16.b Promote and enforce non-discriminatory laws and policies for sustainable development	144	334	478
17 PARTNERSHIPS FOR THE GOALS  GOAL 17: PARTNERSHIP FOR THE GOALS Strengthen the means of implementation and revitalize the global partnership for sustainable development			
17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	78	335	413
17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries	8	43	51
17.3 Mobilize additional financial resources for developing countries from multiple sources	-	3	3
17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	-	-	-
17.5 Adopt and implement investment promotion regimes for least developed countries	30	138	168
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	52	211	263
17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	1	-	1
17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	1	6	7
17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	11	78	89
17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	118	389	507
17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020	1	10	11
17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access	15	39	54
17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence	48	293	341
17.14 Enhance policy coherence for sustainable development	8	20	28
17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development	1	22	23
17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries	1	8	9
17.17 Encourage and promote effective public, public private and civil society partnerships, building on the experience and resourcing strategies of partnerships	21	128	149

17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	5	40	45
17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries	1	76	77

Source: Authors' elaboration.

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