METHODOLOGICAL ANNEX

Questionnaire

The main data collection instrument used for the purposes of this study was the Illicit Arms Flows Questionnaire (IAFQ).[1] The IAFQ was developed by UNODC, in cooperation with relevant international and regional organizations, national and international experts, non-governmental organizations and research entities, to be distributed annually to all Member States in order to collect firearms-related data in a uniform and standardized manner.

The IAFQ consisted of one part on metadata and a separate part on data. Many of the questions in the data file concerned seized arms.[2] In particular, respondents were requested to provide the total number of seized arms in the reference year(s), but also to disaggregate this number according to several criteria, including:

- type (revolver, rifle, pistol, etc.)
- condition (industrially manufactured in factory condition; converted; assembled; reactivated; modified; otherwise illicitly manufactured, including artisanal production)
- marking status (uniquely marked; no marking; altered marking)
- country of manufacture
- legal justification of seizure (illicit possession; illicit use; trafficking; illicit manufacture; altered markings; other)
- type of location of seizure (planes and airports; vessels and harbours; land borders; within national territory; other)
- geographical area/administrative region
- tracing outcome.

Similar information and disaggregations, albeit less detailed, were requested about found and surrendered arms and seized ammunition. The number of seized parts and components was also requested.

While most of the questions related to the entirety of arms seized in the respondent's country in the given reference year(s), data on seizures were also requested on a case by case basis, for a subset of cases deemed "significant".

The recommended criteria for the designation of a seizure as "significant" were:

- more than five arms seized in the given instance;
- involvement of organized crime groups;
- transnational trafficking of arms.

- - -

1   Questionnaire on Illicit Arms Flows. Note by the Secretariat. Sixth Session of the open-ended intergovernmental working group on firearms established by the Conference of the Parties to the United Nations Convention against Transnational Organized Crime, Vienna, 2-3 May 2018. CTOC/COP/WG.6/2018/CRP.2

2   See section "Universe of seized weapons" for a discussion of the range of weapons included under the term "arms".

Respondents were also asked to assess the most frequent routes observed in seizures related to trafficking of arms as well as trafficking of ammunition.

Other topics included the criminal context of seizures (suspected offences beyond the legal justification of seizures), licit and illicit prices of firearms, and qualitative (free text) questions on specific aspects of trafficking worthy of mention (types of arms, modus operandi).

The study focuses mainly on data for 2016-17, collected mainly during 2018, in the first collection cycle of the IAFQ. Some parts of the IAFQ are rotating modules which are disseminated every second year. One rotating module requests data on the criminal justice system in

relation to arms trafficking (prosecutions, convictions, etc.) This module is meant to be disseminated every second year; hence this study does not use data on the criminal justice system.

The IAFQ is available at: https://www.unodc.org/unodc/en/data-and-analysis/statistics/crime/iafq.html

The IAFQ is a refinement of an earlier questionnaire which was used for the purposes of the 2015 UNODC Study on Firearms. Information on this study can be accessed at: http://www.unodc.org/unodc/en/firearms-protocol/firearms-study.html

Availability of data

The following tables summarize the availability of data (for 2016-17) for this study, including data provided through the IAFQ as well as other sources.

TABLE 1 ... IAFQ responses for 2016-17, by region (number of countries, status as of 1 September 2019)

	Any data (including metadata/qualitative data)	Quantitative data
Africa	17	16
Americas	23	22
Asia	12	10
Europe	27	25
Oceania	1	1
Total	**80**	**74**

TABLE 2 ... Availability of data reported through IAFQ, by topic (2016-17, status as of 1 September 2019)

Topic (selected questions grouped by thematic relevance)	Question numbers (IAFQ)	Number of countries with data
Seizures, total and disaggregation by type	1.3	74
Seizures, disaggregation by secondary variables	1.4, 1.5, 1.6, 3.1	65
Criminal context (legal justification and other suspected offences)	2.1, 2.2	53
Found and surrendered	4.1, 4.2., 4.3	51
Ammunition (seizures)	7.1 (2), 7.2	47
Tracing outcome	5.1, 5.2, 5.3	33
Significant seizures	6.1	32
Parts and components (seizures)	7.1 (1)	32
Routing (various questions)	3.3, 7.3, 6.1 (routing information)	26
Tracing requests	5.4, 5.5	18

TABLE 3 ___ Availability of quantitative data for 2016-17, by type of source, selected IAFQ indicators (number of countries/territories)

	Total seized arms (IAFQ question 1.3)	Routes of arms trafficking (IAFQ question 3.3)	Overall (any quantitative IAFQ indicator)
IAFQ	74	18	74
Open-source official national sources	3	0	3
UNODA	4	0	8
WCO*	0	36	40
Total	**81**	**54**	**107**

Data provided by WCO on customs seizures involving weapons and related items made in 2016-17 were available for 59 countries, which together accounted for 3,629 seizure cases. However the scope of this dataset goes beyond the IAFQ indicators and it was not always possible to impute IAFQ indicators from these data. Firearms (a total of 4,941) were involved in 1,567 of these cases.

In addition, the study drew on data collected in the preparation of the 2015 UNODC Study on Firearms.

Universe of weapons

The data collection exercise for this study aimed to capture the universe of seized, found and surrendered firearms as well as small arms and light weapons (SALWs; see glossary for definitions of firearms and SALWs). As mentioned above, the Illicit Arms Flows Questionnaire requested breakdowns of such weapons by type but also according to several other criteria. Based on the breakdown by type, it became apparent that the figures for some countries included some weapons (usually a small minority) which technically did not meet the definition of firearms or SALWs; this included for example air weapons. In other cases insufficient detail was provided to enable to clearly ascertain the type of weapon and to disaggregate firearms and SALWs from additional weapons. Based on available metadata, including metadata on weapons reported under the category "other", an effort was made to classify and record weapons according to the following scheme.

See also figures 1, 5, 11, 18 in *Regional Summary and Trends (Annex).*

Although the above classification attempts to distinguish to the extent possible between the target universe and other weapons, in the parallel disaggregations of the total number of weapons seized (by marking status, condition, etc.), it was not always possible to disentangle from the total those weapons which go beyond the target universe. Moreover, the consideration was also made that some of these additional weapons were also relevant to the scope of this study in that they are often converted into firearms. Thus, the reported figures refer to the total number of reported weapons as "arms", on the premise that the vast majority of these weapons represent firearms, SALWs, or weapons with the potential to be converted into firearms/SALWs.

TABLE 4 ___ Typology of reported weapons

Target universe (firearms/SALWs)	Additional weapons	
Pistols including derringers	Other: Weapons or related items other than firearms/SALWs (undistinguished)	
Revolvers		
Rifles including assault rifles		
Shotguns	Other: Pneumatic, blank-firing and gas weapons	Other: Other weapons/related items
Machine guns		
Submachine guns		
Other: other firearms		
Other: other SALWs		
Other* (unspecified/aggregate)		
Unknown/unclassified		

Includes weapons reported under "other" without sufficient information to allow further classification.

Subregions

The analysis frequently uses a breakdown of the world into subregions. The table below describes the composition of each subregion. This breakdown is based on the standard UN classification (M49), adapted to take into account the availability of data and regions of special interest of the study.

This classification does not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Subregion	Countries and territories
Caribbean	Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Bonaire, Sint Eustatius and Saba; British Virgin Islands; Cayman Islands; Cuba; Curaçao; Dominica; Dominican Republic; Grenada; Guadeloupe; Haiti; Jamaica; Martinique; Montserrat; Puerto Rico; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Sint Maarten (Dutch part); Trinidad and Tobago; Turks and Caicos Islands; United States Virgin Islands
Central America	Belize; Costa Rica; El Salvador; Guatemala; Honduras; Mexico; Nicaragua; Panama
Eastern and South-Eastern Asia	Brunei Darussalam; Cambodia; China; China, Hong Kong Special Administrative Region; China, Macao Special Administrative Region; China, Taiwan Province of China; Democratic People's Republic of Korea; Indonesia; Japan; Lao People's Democratic Republic; Malaysia; Mongolia; Myanmar; Philippines; Republic of Korea; Singapore; Thailand; Timor-Leste; Viet Nam
Eastern Europe	Belarus; Bulgaria; Czechia; Hungary; Poland; Republic of Moldova; Romania; Russian Federation; Slovakia; Ukraine; Former Union of Soviet Socialist Republics
Northern Africa	Algeria; Egypt; Libya; Morocco; Sudan; Tunisia; Western Sahara
Northern America	Bermuda; Canada; Greenland; Saint Pierre and Miquelon; United States of America
Northern and Western Europe	Austria; Belgium; Channel Islands; Denmark; Estonia; Faroe Islands; Finland; France; Iceland; Isle of Man; Latvia; Liechtenstein; Monaco; Netherlands; Norway; Sweden; Switzerland; United Kingdom
Oceania	American Samoa; Australia; Cook Islands; Fiji; French Polynesia; Guam; Kiribati; Marshall Islands; Micronesia (Federated States of); Nauru; New Caledonia; New Zealand; Niue; Northern Mariana Islands; Palau; Papua New Guinea; Samoa; Solomon Islands; Tokelau; Tonga; Tuvalu; Vanuatu; Wallis and Futuna Islands
South America	Argentina; Bolivia (Plurinational State of); Brazil; Chile; Colombia; Ecuador; Falkland Islands (Malvinas); French Guiana; Guyana; Paraguay; Peru; Suriname; Uruguay; Venezuela (Bolivarian Republic of)
Southern Europe (excl. WB)	Andorra; Croatia; Gibraltar; Greece; Holy See; Italy; Malta; Portugal; San Marino; Slovenia; Spain
Western and Middle Africa	Angola; Benin; Burkina Faso; Cabo Verde; Cameroon; Central African Republic; Chad; Congo; Côte d'Ivoire; Democratic Republic of the Congo; Equatorial Guinea; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Liberia; Mali; Mauritania; Niger; Nigeria; Saint Helena; Sao Tome and Principe; Senegal; Sierra Leone; Togo
Western Asia	Armenia; Azerbaijan; Bahrain; Cyprus; Georgia; Iraq; Israel; Jordan; Kuwait; Lebanon; Oman; Qatar; Saudi Arabia; State of Palestine; Syrian Arab Republic; Turkey; United Arab Emirates; Yemen
Western Balkans	Albania; Bosnia and Herzegovina; Kosovo under UNSCR 1244; Montenegro; North Macedonia; Serbia; Former Yugoslavia
Rest of the world	Afghanistan; Bangladesh; Bhutan; Botswana; Burundi; Comoros; Djibouti; Eritrea; Eswatini; Ethiopia; India; Iran (Islamic Republic of); Kazakhstan; Kenya; Kyrgyzstan; Lesotho; Madagascar; Malawi; Maldives; Mauritius; Mayotte; Mozambique; Namibia; Nepal; Pakistan; Réunion; Rwanda; Seychelles; Somalia; South Africa; South Sudan; Sri Lanka; Tajikistan; Turkmenistan; Uganda; United Republic of Tanzania; Uzbekistan; Zambia; Zimbabwe

Notes:

1. The term "Latin America" is used to refer to South America and Central America collectively

2. The term "Latin America and the Caribbean" is used to refer to South America, Central America and the Caribbean collectively.

3. It should be borne in mind that data were not available for each of the countries and territories listed above.

Average distributions

Several indicators requested in the Illicit Arms Flows Questionnaire relate to parallel disaggregations of seized arms. In particular, respondents to the IAFQ were requested to provide breakdowns of the number of seized arms according to eight different criteria, such as type, condition of the seized arm, marking status and legal justification of seizures (see section "Questionnaire" in this Methodological Annex). For most of these disaggregations, the respondent was expected to exhaustively classify the seized arms into one of a finite, fixed number of predetermined options (with the exception of the breakdown by geographical area/administrative region). One variation of this was the breakdown by country of manufacture, where respondents were only expected to provide information on the top 10 countries of manufacture, and classify any remaining countries under " other". The category "other" was also available for several other disaggregations to cater for unforeseen options, as well as "unknown" to cater for consistency of the breakdown.

One of the analytical tools naturally emerging from these data was the distribution of seized arms according to a given criterion; for example, in the case of the breakdown by marking status, the proportions of seized arms which had: (i) unique markings; (ii) altered markings; or (iii) no markings.

Such distributions can be calculated at national level (single country) and at regional/global level (groups of countries). In cases of under-reporting or other cross-country discrepancies in the nature of available data and reporting practices, distributions at national level (expressed as proportions whose sum total is one hundred per cent) may circumvent some of the comparability issues inherent in the absolute figures, as long as the reported data constitute a representative cross-section of the target (standardized) universe of arms. In other words, translating the absolute figures into distributions may enable cross-country comparisons that would otherwise be difficult to interpret.

In the concrete scenario of this study, despite the relatively good coverage, it became apparent that

(a) significant gaps in coverage still existed in seizure data, including the absence of data from large countries;

(b) variations in the nature of the reported seized arms (e.g. the inclusion of seizures of an administrative nature) impacted the magnitude of the seizure figures and thus translated into significant issues in the cross-country comparability of the absolute numbers (even if these factors did not necessarily impact the distributions);

(c) some countries were significantly affected by under-reporting in a cross-cutting fashion (independently of geographical or institutional coverage);

(d) the above factors together led to regional and global totals being driven by a small number of countries, and could potentially skew the magnitude of seizures in countries relative to each other.

In view of the above, throughout the study the various distributions, when presented at regional or global level, refer predominantly to the simple (unweighted) average of national distributions (which is itself a distribution), rather than the distribution of global totals.

The analysis of these distributions at regional or global level frequently calls for a sharpened focus on a subset of the predetermined categories. For example, the category "unknown" usually does not add to the understanding of the issue at hand and needs to be set aside in order to avoid distorting (reducing) the importance of the categories of interest. Similarly, some reported weapons, such as air guns or knives, extend beyond the target universe of firearms and SALWs, and therefore need to be set aside in the analysis by type. This can be achieved by "renormalizing" the distributions before *or* after the regional/global aggregation (taking of averages). Given the presence of the category "unknown" (including shortfalls arising from non-comprehensive reporting) in these disaggregations, and the occurrence of instances where this component accounted for more than a majority of seized arms, the renormalization step was done *after* the aggregation step (taking of averages) so as to reduce the impact of single uncharacteristic distributions (outliers) arising from incomplete reporting. This step was necessary for the analysis of various indicators, including SDG indicator 16.4.2.

Illicit Flows

Countries were requested to provide information on the most frequent routes that were observed in seizures related to arms trafficking made by their own authorities. Reported itineraries were allowed to include segments both *prior* to the country of seizure (incoming seizures) as well as intended segments *subsequent* to the country of seizure (outgoing seizures), and potentially both (seizures in transit). Respondents were asked to rank the routes and, where possible, to include the number of arms seized along each route.

The reported data exhibited the following characteristics:

(i) Data on incoming seizures tended to be more comprehensive, and appeared to be overall more reliable, than data on outgoing seizures.

(ii) Respondents who replied to this question were able to rank the various routes, but very few countries provided the number of arms associated with each route.

(iii) The response rate for this question was relatively low.

In order to improve the coverage, data on seizures of arms by Customs authorities, made available by the World Customs Organization, were used to supplement the data from the Illicit Arms Flows Questionnaire; this was based on the assumption that, while Customs seizures may only constitute a subset of all cross-border seizures, and while not all Customs seizures may be instances of trafficking, they nevertheless were representative (in relative terms, even if not in absolute terms) of transnational trafficking patterns. Specifically, the total number of firearms/SALWs seized by customs authorities of a given country in each customs seizure case was aggregated per itinerary and used to rank these itineraries.

As a second step, data on incoming seizures were used, for each seizing country with available data, to generate distributions—at national level—of incoming flows by country of departure and, separately, distributions of outgoing flows by country of destination. Although incoming and outgoing flows were treated separately, seizures in transit contributed to both incoming and outgoing flows. In cases where the numbers of arms seized on the corresponding itineraries were reported, these numbers were used to establish the relative proportions attributable to the corresponding countries of departure. When these numbers were not available, a decreasing function of rank—specifically $1/i$, where $i=1,2,3,\ldots$ stands respectively for first, second, third ranked, etc.—was used to establish the relative weights of the itinerary (and consequently the country of departure). For example, if country X ranked second ($i=2$) an itinerary starting with country of departure A and third ($i=3$) an itinerary starting with country of departure B, the relative contributions to A and B would be in the ratio of 3:2 (= 1/2 : 1/3). The final proportions were, of course, determined by renormalizing over all reported incoming itineraries and hence the shares for A and B would also depend on all the other incoming itineraries. An analogous approach was used to assign weights to itineraries in order to generate distributions by countries of destination.

As a third step, the incoming and outgoing distributions at national level were aggregated at subregional level by means of weighted averages. In the absence of adequate weights which could take into account the numerous factors affecting cross-country comparability (including, in this context, the effectiveness of law enforcement efforts in detecting and seizing trafficked arms), and in view of the fact that some subregions included data for a very small number of countries, the population of the countries of seizure was used as a weight.

As a fourth step, the problem of establishing the relative magnitude of illicit flows between subregions was conceptualized as that of finding the values (up to a multiplicative constant) in a square matrix with the rows and columns indexed by the subregions. The outgoing and incoming distributions can be visualized as constraints on the entries of the matrix; however, this approach would yield an over-determined system of equations. In view of this, the problem was transformed into one of constrained optimization: the *incoming* distributions were retained as constraints, while the *outgoing* distributions were viewed as target distributions, and the entries in the matrix were optimized, subject to the constraints arising from the incoming distributions, to approximate the target outgoing distributions as much as possible. Specifically, a discrepancy function (penalty function) was constructed to measure

FIG. 1 ⎯⎯ Estimated transnational illicit firearms flows, breakdowns by subregions of departure and arrival (quantity of trafficked arms), 2016-17
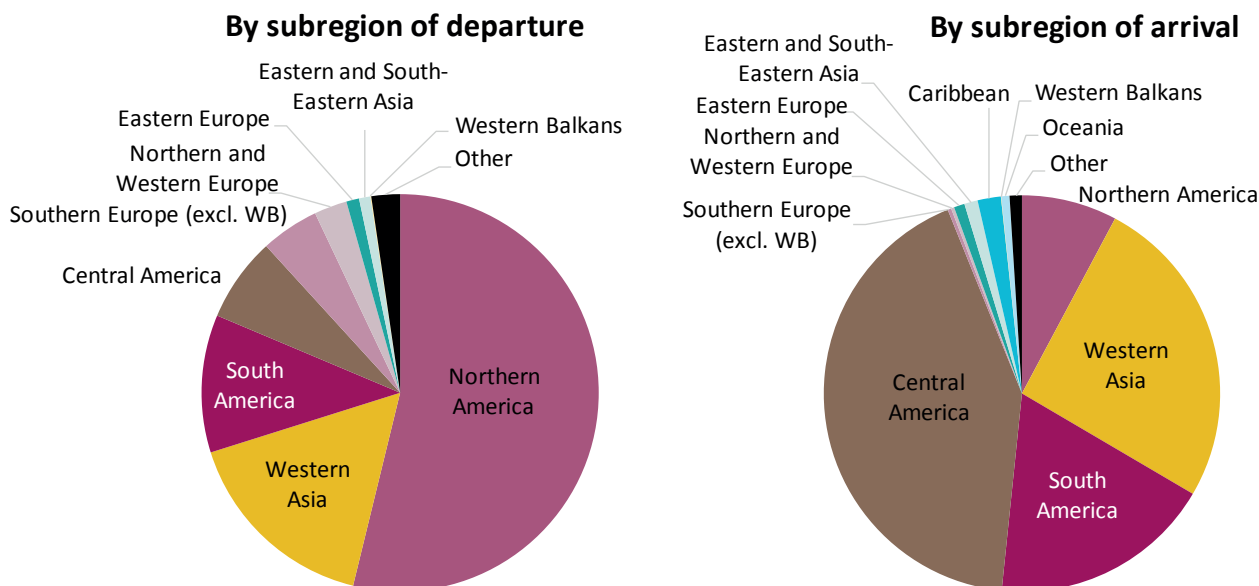
FIG. 2 ___ Estimated *inter-regional* illicit firearms flows, by region/subregion of departure (quantity of trafficked arms), 2016-17
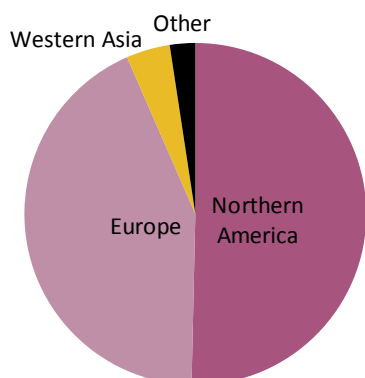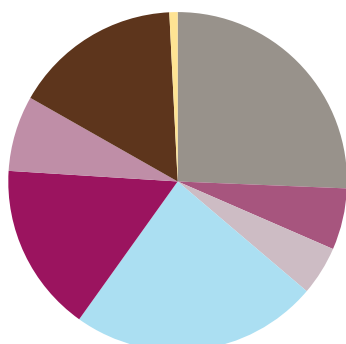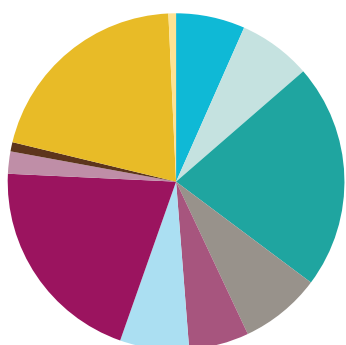

FIG. 3 ___ Estimated outgoing illicit firearms flows from selected subregions,* by subregion of destination (quantity of trafficked arms), 2016-17

From Western Asia

From Northern and Western Europe

■ Caribbean ■ Central America
■ Eastern and South-Eastern Asia ■ Eastern Europe
■ Northern Africa ■ Northern America
■ Northern and Western Europe ■ Oceania
■ South America ■ Southern Europe (excl. WB)
■ Western and Middle Africa ■ Western Asia
■ Western Balkans

Excluding transnational flows within the subregion.

the overall discrepancy between the actual outgoing distributions (induced by the matrix entries) and the expected target distributions obtained from step 3; the values of the matrix were then optimized to minimize this penalty function while fully respecting the constraints arising from the incoming distributions. The penalty function was constructed as a sum of components, one per subregion. For each subregion, the corresponding component was calculated as the sum of squares of differences between actual distributions and the target distributions, weighted by the total quantity going out from countries in that subregion.

The ensuing values are represented in the illicit flows maps included in Chapter 3 (maps 4-10). These values are also the basis for the following figures, which further support some of the analysis in Chapter 3.

SDG Indicator 16.4.2

In the context of the follow-up and review of the 2030 Agenda for Sustainable Development, UNODC has been designated as co-custodian for Sustainable Development Goal 16.4.2 ("Proportion of seized, found or surrendered arms whose illicit origin or context has been traced or established by a competent authority in line with international instruments").

The IAFQ questionnaire was also designed to collect data relevant for the calculation of this indicator, specifically through question 5; the relevant data is included in the data file alongside the other indicators. The value of the indicator will be calculated on the basis of the finalized data according to the following formula:

$$SDG\ 16.4.2 = \frac{Successfully\ traced\ arms\ of\ illicit\ origin}{Potentially\ traceable\ arms\ of\ illicit\ origin}$$

$$= \frac{\#1.2 + \#1.3 + \#1.4}{\#1.2 + \#1.3 + \#1.4 + \#1.5 + \#1.6 + \#1.7 + \#3}$$

where the designations #*x.y* refer to the numbering of the categories in question 5 of the IAFQ (see example below). Please note that "traceable" refers to arms which are traceable through marking. The calculation can in principle be performed separately for each of arms seized, arms found and arms surrendered.

The example in table 5 on page 8 gives an illustration of this formula in practice.

TABLE 5 ⸻ Example calculation of Indicator 16.4.2 for arms seized

Data as reported in the IAFQ:

5.1. Total number of arms seized, disaggregated by outcome of tracing and other follow-up activities				
Type of Weapon	**Outcome of tracing / Follow-up activities**	**2016** Total arms seized	**2017** Total arms seized	**Remarks**
1. Uniquely identifiable through marking	1.1. Weapon seized from its legitimate owner and weapon found in national registry		56	
	1.2. Weapon seized from illegitimate owner and weapon found in national registry (e.g., lost or stolen) (national tracing)		22	
	1.3. Point of diversion of the weapon (last legal record) identified through tracing and weapon found in foreign registry (international tracing)		12	
	1.4. Point of diversion otherwise established by a competent authority; please specify		3	
	1.5. Tracing attempted, but not enough information to identify point of diversion		9	
	1.6. Tracing procedure still pending		12	
	1.7. No tracing procedure initiated		5	
	1.8. Total			
2. Not uniquely identifiable	2.1. Illicitly manufactured		3	
	2.2. Erased or altered marking		10	
	2.3. No information available about the item		15	
	2.4. Total			
3. Unknown status with respect to marking			20	
4. Total (lines 1.8. + 2.4. + 3.)				

Calculation of SDG 16.4.2

$$SDG\ 16.4.2 = \frac{\#1.2\ +\ \#1.3\ +\ \#1.4}{\#1.2\ +\ \#1.3\ +\ \#1.4\ +\ \#1.5\ +\ \#1.6 +\ \#1.7\ +\ \#3}$$

$$= \frac{22 + 12 + 3}{22 + 12 + 3 + 9 + 12 + 5 + 20} \approx \mathbf{44.6\%}$$

Estimates of homicide by mechanism according to situational context

Countries report homicide data to UNODC via the United Nations Survey of Crime Trends and Operations of Criminal Justice Systems. Countries have been requested, in several data collection cycles, to provide breakdowns of the total number of homicides in a given year according to several (independent) criteria, including breakdowns by mechanism (firearm, knife/sharp object, etc.) and breakdowns by situational context (robbery, family/intimate partner settings, organized crime, etc.).

A very limited dataset was available giving empirical information on cross-disaggregations by situational context *and* mechanism; see Figure 6 in Chapter 4. However, such cross-disaggregations are not routinely collected.

Independent disaggregations by situational context and mechanism were available for several countries; for some of these countries, the data were sufficiently detailed and available for sufficiently many years so as to allow to estimate breakdowns by mechanism according to situational context; in other words, a breakdown into homicides by firearm, homicides by sharp object, and homicides by other mechanism, specifically for each situational context (robbery, family/intimate partner settings, organized crime, etc.). See Figures 7 and 8 in Chapter 4.

The methodology used for these estimates was based on the assumption of stability over time; in other words, it was assumed that, for each situational context, the distribution by mechanism was constant (even if *a priori* unknown) over time. Given any fixed choice for these

distributions, this would then induce a new (theoretical) breakdown by mechanism of the total number of homicides in any given year (across all situational contexts); this induced distribution can then be compared against the empirical disaggregation already available (as reported).

The determination of the best choice for each of the distributions by mechanism (one for each situational context) was then tackled as an optimization problem by minimizing the discrepancy between the induced breakdowns and the available breakdowns (by mechanism); specifically, the discrepancy was calculated as the sum, over all years and all mechanisms, of the squares of differences between the induced and reported absolute values of the numbers of homicide by specific mechanisms.