

# Appendix GMI 2022:

## I. Procurement in connection with the Special Fund

### A. Derivation of the Number of Heavy Weapons for the Scenario Calculation

This section provides an overview of the heavy weapons likely to be procured under the Special Fund and our estimate of how this will affect the number of heavy weapons used by the Bundeswehr and covered by the GMI. Since the funds of the special fund are to be spent<sup>1</sup> and the goals of the medium-term personnel planning are to be implemented by 2026, this year forms the time horizon for our following forecast. Based on extrapolated data for 2026, we will estimate Germany's degree of militarisation for the year 2027.

Already in the basic document "Concept of the Bundeswehr" from 2018, the necessary capabilities of the Bundeswehr were developed along four dimensions or operational spaces (land, air/space, sea and cyber). The procurement debates have since followed this classification, and this is why we also follow it. As a restriction, we will not consider the cyber dimension, as it has no influence on the number of heavy weapons.

#### Land dimension

€16.6 billion of the Special Fund are available for the land dimension. These funds are to be used primarily to replace the Marder, Fuchs and Wiesel vehicles or to modernise those of the type Puma. At the time of writing, it can be assumed that only a part of all Marder infantry fighting vehicles will be replaced by the newer Puma type. The tasks of the Marder will in all likelihood be taken over by new Boxer vehicles, similar to the Wiesel. A new airborne vehicle is also to be procured to replace the Wiesel. Since the total demand for vehicles will remain the same, it can be assumed that the number of new acquisitions and decommissioning will be balanced. However, since the successor models will have more powerful armament, more of these vehicles will in all likelihood be included in the GMI calculation. In concrete terms, it is about 102 Wiesel vehicles that are currently not included in the calculation. The development of the new Main Ground Combat System (MGCS)—successor to the Leopard 2—is also to be financed through the Special Fund. However, the MGCS will not be in the testing phase until 2028 and will thus have no influence on the militarisation level in 2027. The newly to be procured vehicles for navigating snow covered terrain are also not included in the calculation of the GMI.

**Achieved target scenario:** Due to heavier armament of the new successor vehicles to be procured, there is an increase in the number of heavy weapons by 102 systems, even though the number of vehicles remain unchanged.

**Missed target scenario:** The new vehicles to be procured do not contribute to an increase in the number of heavy weapons (within the framework of the GMI).

#### Sea dimension

Almost €20 billion of the Special Fund are allocated to the sea dimension. According to an ambitious plan for the German Navy, it is to have 25 warships and eight submarines by 2032. Currently, the navy has eleven warships and six submarines. Therefore, an increase is to be expected here in the coming years. The Special Fund will be used to finance, among other things, two Class 212 submarines, which were already ordered last year and are to be put into

service by 2032. In addition, four F 126 frigates are currently under construction and are to be completed by 2028. If necessary, two more could be financed through the Special Fund. However, these would not be put into service until 2027. Currently, four Type 130 corvettes are also still under construction. The first of the original five-vessel order - the Köln - was commissioned this year, the others are to follow by 2025. Five additional vessels could be financed by the Special Fund. However, the delivery of a maximum of two of these vessels by 2027 could be conceivable.

**Achieved target scenario:** Ten additional vessels (one submarine, three frigates, six corvettes) can be expected by 2027.

**Missed target scenario:** Only six of the planned warships have been commissioned into the German Navy (two frigates plus four corvettes).

### **Air dimension**

The largest part of the Special Fund of €40 billion is allotted to the air dimension. Here, 60 new heavy transport helicopters are to be procured to replace the 70 CH-53 Ks currently in service. In addition, five maritime reconnaissance aircraft are to be purchased. Both systems are not included in the GMI, as they are unarmed. Furthermore, the 93 Tornados currently in service are to be replaced by a combination of 35 F-35As from the US manufacturer Lockheed Martin and additional Eurofighters. Since the number of aircraft is not expected to change, this will not affect the number of heavy weapons in the GMI. Yet, the decision to put seven armed Eurodrones into service by 2025 and to arm six previously leased unarmed Heron TP drones is likely to have an impact. Likewise, the procurement of up to 55 light support helicopters, presumably the Airbus H145M, is planned, which could well be delivered by 2027. Since they will be armed as support helicopters, these additional 55 aircraft would have an impact on the GMI.

**Achieved target scenario:** In the air dimension, there could be an increase of 68 systems (13 armed drones and 55 support helicopters).

**Missed target scenario:** However, an increase of 43 systems (13 armed drones and 30 support helicopters) is likely to be realistic, as not all H145Ms have been delivered so far.

### **Total number of heavy weapons**

For the achieved target scenario, we assume an increase in the number of heavy weapons by **180 systems**. This is mainly due to the fact that newly procured successor vehicles have more powerful weapons and are thus recorded in a different category. In addition, there are armed drones and additional vessels for the navy.

In the missed target scenario, the number of heavy weapons increases by only **49 systems**, as it is unlikely that many can be delivered by 2026. The higher number of heavy weapons is largely due to armed drones and new armed utility military helicopters and additional naval vessels.

## B. Scenario calculation

Below you will find the data we used to calculate the two scenarios for Germany's level of militarisation in 2027, as well as the final ranking table. Please note that this contains one country less (153) compared to the ranking table for 2022. This is due to the fact that Qatar is represented in the GMI in 2022 for the first time since 2013; however, there are insufficient previous year values to estimate the degree of militarisation in the future.

### Germany, scenario 1: Achieved target

	Score	log10(value+1)	min log	max log	normalised
population	83,828,939	7.923393975			
GDP in US \$	4,578,760,112,349	12.66074789			
Heavy weapons	3,677	3.565611725			
Health expenditures / GDP	12.26215724	1.122614173	0	1.612741	0.6960908
Number of soldiers	203,000	5.307498177			
Number of soldiers, reserve	34,900	4.542837871			
Military expenditures / GDP	2	0.477121255	0	2.073168	0.230141144
Number of physicians	401,791	5.604000745			
Military expenditures / health expenditures	0.163103438	0.065618339	0	1.565132	0.041925115
Active soldiers / total population	0.002421598	0.001050415	0	0.03632715	0.028915436
Active soldiers / number of physicians	0.505238426	0.177605297	0	3.301247	0.053799457
Reserve / total population	0.000416324	0.00018077	0	1.612741	0.000112088
Number of heavy weapons / total population	4.386313419	0.731291621	0	2.560594	0.285594522

<b>Expenditure Index</b>	1.28
<b>Personnel Index</b>	0.22
<b>Heavy Weapons Index</b>	1.14
<b>GMI-score</b>	<b>132.11</b>

## Germany, scenario 2: Missed target

	Score	log10(value+1)	min log	max log	normalised
population	83,828,939	7.923393975			
GDP in US \$	4,578,760,112,349	12.66074789			
Heavy weapons	3,546	3.549861188			
Health expenditures / GDP	12.26215724	1.122614173	0	1.612741	0.6960908
Number of military personnel	185,000	5.267174076			
Number of soldiers, reserve	31,900	4.503804297			
Military expenditures / GDP	1.528798152	0.402914166	0	2.073168	0.194347089
Number of physicians	401,791	5.604000745			
Military expenditures / health expenditures	0.124676117	0.051027473	0	1.565132	0.032602664
Active soldiers / total population	0.002206875	0.000957378	0	0.03632715	0.026354329
Active soldiers / number of physicians	0.46043896	0.16448341	0	3.301247	0.04982463
Reserve / total population	0.000380537	0.000165234	0	1.612741	0.000102455
Number of heavy weapons / total population	4.230042802	0.718505243	0	2.560594	0.280601002

<b>Expenditure Index</b>	1.07
<b>Personnel Index</b>	0.21
<b>Heavy Weapons Index</b>	1.12
<b>GMI-score</b>	<b>119.86</b>

## Estimated ranking table GMI 2027

Country	ISO code	GMI-score	Rank
Israel	ISR	337,30	1
Kuwait	KWT	326,59	2
Armenia	ARM	316,29	3
Azerbaijan	AZE	310,55	4
Greece	GRC	296,11	5
South Sudan	SSD	292,05	6
Russia	RUS	284,20	7
Oman	OMN	281,71	8
Brunei	BRN	278,07	9
Jordan	JOR	276,92	10
Bahrain	BHR	274,56	11
Morocco	MAR	270,46	12
Cyprus	CYP	268,37	13
Ukraine	UKR	266,31	14
Korea, Republic of	KOR	263,88	15
Singapore	SGP	260,69	16
Saudi Arabia	SAU	258,88	17
Algeria	DZA	257,98	18
Montenegro	MNE	251,98	19
Lithuania	LTU	242,47	20
Belarus	BLR	230,56	21
Finland	FIN	230,39	22
Lebanon	LBN	220,74	23
Croatia	HRV	220,07	24
USA	USA	219,51	25
Botswana	BWA	217,26	26
Turkey	TUR	216,88	27
Estonia	EST	215,20	28
Macedonia	MKD	215,12	29
Chad	TCD	209,83	30
Serbia	SRB	208,60	31
Uganda	UGA	208,52	32
Iraq	IRQ	208,40	33
Tunisia	TUN	207,91	34
Cuba	CUB	204,27	35
Latvia	LVA	203,45	36
Mali	MLI	201,39	37
Vietnam	VNM	201,24	38

<b>Pakistan</b>	PAK	200,96	39
<b>Uzbekistan</b>	UZB	200,85	40
<b>Mauritania</b>	MRT	199,44	41
<b>Norway</b>	NOR	194,56	42
<b>Uruguay</b>	URY	193,01	43
<b>Congo, Republic of</b>	COG	192,85	44
<b>Romania</b>	ROU	191,68	45
<b>Slovakia</b>	SVK	190,58	46
<b>Mongolia</b>	MNG	188,55	47
<b>Egypt</b>	EGY	187,77	48
<b>Kyrgyzstan</b>	KGZ	186,99	49
<b>Bulgaria</b>	BGR	186,20	50
<b>Myanmar</b>	MMR	185,84	51
<b>Namibia</b>	NAM	182,12	52
<b>Georgia</b>	GEO	181,68	53
<b>Burkina Faso</b>	BFA	181,38	54
<b>Poland</b>	POL	177,98	55
<b>Hungary</b>	HUN	174,46	56
<b>Iran</b>	IRN	174,09	57
<b>Gabon</b>	GAB	172,35	58
<b>Guinea-Bissau</b>	GNB	168,35	59
<b>Switzerland</b>	CHE	167,46	60
<b>Albania</b>	ALB	167,15	61
<b>Central African Republic</b>	CAF	163,87	62
<b>France</b>	FRA	161,45	63
<b>Czech Republic</b>	CZE	161,11	64
<b>Chile</b>	CHL	159,37	65
<b>Togo</b>	TGO	159,30	66
<b>Portugal</b>	PRT	158,16	67
<b>Sri Lanka</b>	LKA	157,15	68
<b>Italy</b>	ITA	157,12	69
<b>India</b>	IND	156,40	70
<b>Equatorial Guinea</b>	GNQ	156,21	71
<b>Rwanda</b>	RWA	155,45	72
<b>Colombia</b>	COL	152,99	73
<b>Thailand</b>	THA	152,12	74
<b>Australia</b>	AUS	151,18	75
<b>Burundi</b>	BDI	150,16	76
<b>Sweden</b>	SWE	144,66	77
<b>Netherlands</b>	NLD	143,88	78
<b>United Kingdom</b>	GBR	142,19	79

<b>Denmark</b>	DNK	141,89	80
<b>Austria</b>	AUT	140,85	81
<b>Spain</b>	ESP	139,62	82
<b>Slovenia</b>	SVN	138,27	83
<b>Mozambique</b>	MOZ	136,46	84
<b>Kazakhstan</b>	KAZ	134,80	85
<b>Fiji</b>	FJI	134,37	86
<b>Cambodia</b>	KHM	134,07	87
<b>Ecuador</b>	ECU	132,57	88
<b>Germany (Szenario I)</b>	DEU	132,12	89
<b>Bolivia</b>	BOL	130,55	90
<b>Senegal</b>	SEN	130,44	91
<b>El Salvador</b>	SLV	129,92	92
<b>Moldova</b>	MDA	128,80	93
<b>Bosnia and Herzegovina</b>	BIH	128,78	94
<b>Peru</b>	PER	128,37	95
<b>Cameroon</b>	CMR	127,86	96
<b>Jamaica</b>	JAM	124,35	97
<b>Canada</b>	CAN	122,31	98
<b>Germany (Szenario II)</b>	DEU	119,86	98
<b>China</b>	CHN	119,81	99
<b>Belgium</b>	BEL	119,44	100
<b>Gambia</b>	GMB	117,64	101
<b>Nigeria</b>	NGA	115,56	102
<b>Angola</b>	AGO	114,61	103
<b>New Zealand</b>	NZL	111,15	104
<b>Nicaragua</b>	NIC	109,85	105
<b>Luxembourg</b>	LUX	109,58	106
<b>Niger</b>	NER	105,12	107
<b>Malaysia</b>	MYS	104,82	108
<b>Ethiopia</b>	ETH	104,46	109
<b>Belize</b>	BLZ	104,24	110
<b>Zambia</b>	ZMB	102,34	111
<b>Bangladesh</b>	BGD	102,11	112
<b>Paraguay</b>	PRY	99,78	113
<b>South Africa</b>	ZAF	98,37	114
<b>Malawi</b>	MWI	96,89	115
<b>Cote D'Ivoire</b>	CIV	96,79	116
<b>Japan</b>	JPN	95,67	117
<b>Tanzania</b>	TZA	94,26	118
<b>Mexico</b>	MEX	94,22	119

<b>Brazil</b>	BRA	92,61	120
<b>Tajikistan</b>	TJK	91,49	121
<b>Dominican Republic</b>	DOM	90,28	122
<b>Timor-Leste</b>	TLS	87,19	123
<b>Sierra Leone</b>	SLE	86,24	124
<b>Honduras</b>	HND	85,88	125
<b>Nepal</b>	NPL	83,26	126
<b>Seychelles</b>	SYC	83,13	127
<b>Afghanistan</b>	AFG	83,12	128
<b>Kenya</b>	KEN	81,45	129
<b>Guinea</b>	GIN	80,17	130
<b>Papua New Guinea</b>	PNG	80,13	131
<b>Guyana</b>	GUY	80,11	132
<b>Madagascar</b>	MDG	77,69	133
<b>Sudan</b>	SDN	77,43	134
<b>Indonesia</b>	IDN	76,18	135
<b>Philippines</b>	PHL	71,07	136
<b>Ghana</b>	GHA	69,87	137
<b>Liberia</b>	LBR	68,05	138
<b>Argentina</b>	ARG	63,14	139
<b>Lesotho</b>	LSO	60,01	140
<b>Benin</b>	BEN	59,60	141
<b>Ireland</b>	IRL	59,37	142
<b>Trinidad and Tobago</b>	TTO	52,46	143
<b>Cape Verde</b>	CPV	49,60	144
<b>Zimbabwe</b>	ZWE	48,48	145
<b>Venezuela</b>	VEN	44,87	146
<b>Congo, Democratic Republic of the</b>	COD	42,70	147
<b>Panama</b>	PAN	41,26	148
<b>Guatemala</b>	GTM	38,62	149
<b>Mauritius</b>	MUS	38,23	150
<b>Malta</b>	MLT	27,63	151
<b>Haiti</b>	HTI	25,76	152
<b>Costa Rica</b>	CRI	9,66	153



## II. Data Sources for the Calculation of the Degree of Militarization of North Korea and Taiwan

In this document, you will find the data sources that form the basis of our calculations of North Korea's and Taiwan's levels of militarisation. These differ in part from our typically used sources, which are considered to be reasonably reliable. Against this background, these alternative sources must be used with great caution. Our calculation methodology can be found on page 4 of the GMI 2022 or in our Codebook accompanying the GMI (<https://gmi.bicc.de>).

### North Korea

#### Expenditure Index

The Expenditure Index relates a country's military spending to its gross domestic product (GDP) and compares this value to its government's spending on health, also measured against its GDP.

For the first indicator, we usually source data on military spending from the Military Expenditure Database of the Stockholm Peace Research Institute (SIPRI). However, since this does not contain sufficiently up-to-date data on North Korea, we have substituted it with data from the [World Military Expenditures and Arms Transfers \(WMEAT\)](#), published by the US Department of State. The data is from its 2021 report, which contains data from 2019. The data is thus within our tolerance level in terms of timeliness but is considered highly unreliable by the Department of State itself. WMEAT also provides data on GDP, or via the indicator "military burden", the ratio of military expenditure as a share of GDP, which we need to calculate the Expenditure Index. This ratio is estimated at 26.4 per cent for 2019.

Data on health expenditures is usually obtained from the Global Health Observatory Data Repository of the World Health Organization (WHO). However, this does not contain any data for North Korea, so we had to use a different source again. The most up-to-date data we could find here comes from the Country Cooperation Strategy of the WHO with North Korea, which covers the period 2014 to 2019 and shows health expenditures as a percentage of GDP of 6.4 per cent for 2014. Yet, this data does not comply with our minimum requirements regarding the timeliness of data: Data on health expenditures must not be older than five years.

Overall, the value calculated for the Expenditure Index is, therefore, highly unreliable.

#### Personnel Index

The Personnel Index is made up of three separate indicators. For one, it sets active (para-)military personnel in relation to the total population. The second indicator takes the percentage of reserve forces measured against the total population into account. The third indicator compares the total number of (para-)military forces with the number of physicians working in a country. All data on military personnel is taken from the current 2022 edition of the *Military Balance* of the International Institute for Strategic Studies (IISS) and thus our regular source.

<b>Military personnel</b>	<b>Number</b>
Active military personnel	1,280,000
Paramilitary personnel	189,000
Reserve	600,000

Population figures are also taken from our regular source, the [World Bank](#). It puts the current (2021) figure for North Korea at 25,887,045. The last figure, the number of physicians working in a country, has been taken from our regular source, the WHO's [Global Health Workforce Statistics database](#). The latest data, however, refers to 2016 and is thus just short of our five-year requirement regarding the timeliness of data. The WHO puts the total number of physicians in the DPRK for 2016 at 93,667, which corresponds to 3.7 per 1,000 inhabitants.

Overall, the value calculated for the Personnel Index is quite unreliable due to the fairly outdated number of physicians.

## **Heavy Weapons Index**

The Heavy Weapons Index indicates the number of heavy weapons in the arsenals of the armed forces of the respective country in relation to the overall population. For North Korea, data on heavy weapons are also sourced from the IISS Military Balance. It is from the current 2022 edition and thus complies with our quality standards on the timeliness of data.<sup>1</sup>

<b>Types of weapons</b>	<b>Number</b>
Battle tanks	3,500
Light tanks	560
Armoured personnel carriers	2,532
Self-propelled gun carriages/-howitzers	8,600
Towed guns	-
Multiple rocket launchers	5,500
Combat aircraft	563
Combat helicopters	-
Submarines	71
Naval surface vessels	2
Loitering munitions	-
Combat drones	-
Military satellites	-
<b>TOTAL</b>	<b>21,328</b>

The second parameter for calculating the Heavy Weapons Index also originates from our regular data source, the [World Bank](#). It puts the 2021 population figures for North Korea at 25,887,045.

Overall, the figure calculated for the Personnel Index is thus fairly reliable.

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<sup>1</sup>As military expenditure and military personnel data as well as the number of heavy weapons lie at the heart of the Index, this data must not be older than three years. Other data, such as information on health expenditures and the number of physicians, must not be older than five years.

## Taiwan

### Expenditure Index

The Expenditure Index relates a country's military spending to its gross domestic product (GDP) and compares this value to its government's spending on health, also measured against its GDP.

For the first indicator, we usually source data on military spending from the Military Expenditure Database of the Stockholm Peace Research Institute (SIPRI). Here, data is also available for Taiwan for the year 2021, so we were able to draw on original data, which are reported as US \$12.09 billion (in constant prices with 2020 as the base year) or 1.74 per cent of GDP. Data on health expenditures is usually obtained from the Global Health Observatory Data Repository of the World Health Organization (WHO). However, this does not contain any data for Taiwan, so we had to use a different source.

The Taiwanese [Ministry of Health and Welfare](#) puts health expenditures as a share of GDP for 2020 at 6.7 per cent.

All data used to calculate the Expenditure Index is from 2021 and is thus well within the usual tolerance thresholds. As data is taken from official statistics or the usual sources of the GMI, the estimate can be considered fairly reliable.

### Personnel Index

The Personnel Index consists of three separate indicators. For one, it sets active (para-)military personnel in relation to the total population. The second indicator takes the percentage of reserve forces measured against the total population into account. The third indicator compares the total number of (para-)military forces with the number of physicians working in a country. All data on military personnel is taken from the current 2022 edition of the *Military Balance* of the International Institute for Strategic Studies (IISS) and thus our regular source.

<b>Military personnel</b>	<b>Number</b>
Active military personnel	169,000
Paramilitary personnel	11,800
Reserve	1,657,000

Our regular source for the population figures necessary for calculating the Personnel Index is the [World Bank](#). However, as it does not make any data available for the country, which is only recognised by a few states, we took the data from the [Statistical Yearbook of the Republic of China](#)—Taiwan's official statistics. Population figures also originate from the Statistical Yearbook and are put at 23,375,000 for 2021. We also used the figures for the last indicator, the number of working physicians, which we usually take from the WHO's [Global Health Workforce Statistics database](#), from the [Statistical Yearbook of the Republic of China](#). In 2021, this puts the total number of physicians working in hospitals and other healthcare institutions at 52,175. The number of doctors per 1,000 inhabitants is 2.2.

As data is taken from fairly reliable sources and is up-to-date, the calculated value for the Personnel Index can be considered fairly reliable.

## Heavy Weapons Index

The Heavy Weapons Index indicates the number of heavy weapons in the arsenals of the armed forces of the respective country in relation to the overall population. For Taiwan, data on heavy weapons is also sourced from the IISS Military Balance. It is from the current 2022 edition and thus complies with our quality standards on the timeliness of data.

<b>Types of weapons</b>	<b>Number</b>
Battle tanks	850
Light tanks	100
Armoured personnel carriers	1,575
Self-propelled gun carriages/-howitzers	488
Towed guns	1,060
Multiple rocket launchers	223
Combat aircraft	462
Combat helicopters	96
Submarines	4
Naval surface vessels	26
Loitering munitions	0
Combat drones	0
Military satellites	1
<b>TOTAL</b>	<b>4,885</b>

The second parameter for the calculation of the Heavy Weapons Index, the population figures, originates, as already described in the section for the Personnel Index, in the Statistical Yearbook of the Republic of China and is put there at 23,375,000 for 2021.

All in all, the calculated value for the Personnel Index can be considered fairly reliable due to the current figures and the reliable data sources.