SCIENTIFIC CULTURE

www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 1.1, (2026), pp. 1613-1618
Open Access. Online & Print

DOI: 10.5281/zenodo.11425217

APPLYING SIX SIGMA SCALE TO MEASURE THE OPERATIONAL QUALITY OF COMBATING -DRUGS UNITS

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Received: 10/10/2025
Accepted: 10/11/2025

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ABSTRACT

Drug crimes have become a phenomenon that plagues countries, societies, and individuals. To combat them, countries have established specialized anti-drug units. Despite the efforts made, these units have not been able to eradicate this crime. This research statistically evaluates the work of these units using the Six Sigma scale to determine the level of performance quality of these units, enabling improvement or change in the methods used. It also compares the performance of different units to identify causes and provide treatment and support to the underperforming units. Due to the confidentiality of data in this field and the hypothetical dataset reflects real-world conditions by using realistic values, natural variability, and typical relationships between variables, making it suitable for practical analysis and testing, hypothetical data was used for a country with two border regions, A and B. The research aimed to measure and compare the performance of anti-drug units at the national level and the two regions. Results were obtained that measured these objectives and revealed a general weakness in the performance of units working to combat drugs in this hypothetical country in general, and in both regions. Recommendations included improving drug control methods in this country, through modification or change. It was also recommended to support Region A in the event of a lack of resources, given its declining performance compared to Region B.

KEYWORDS: Drugs, Combating Drugs Units, 6 – Sigma.

1. INTRODUCTION

Narcotics are addictive drugs that act as depressants upon the nervous system. The term (narcotic) refers to an agent that inhibits and suppresses the activity of one's intellect, due to chemical substances that cause drowsiness, sleeping or falling unconscious. Addiction – substance or drug abuse – may lead to (dependence syndrome), which involves a cluster of physiological, behavioral, and cognitive phenomena in which the use of substances takes on a much higher priority for a given individual. This usually includes a strong desire or sense of compulsion to take the substance despite its harmful consequences, as well as a physiological withdrawal state (Health.KSA, 2024). There are two types of drugs: natural, which are used either in their natural state or are simply transformed from their plant origin, and the second type is manufactured in laboratories and takes the form of pills or liquids (1). Addiction occurs as a result of the interaction between three main factors: the drug, the person, and society (2). The World Drug Report 2024 showed that the number of people using illicit drugs worldwide is approximately 300 million, an increase of 8 million people compared to 2022 -292 million in 2022- (Nations, 2024). The World Health Organization (WHO) has released a new report highlighting that alcohol use caused deaths of 2.6 million annually, accounting for 4.7% of all deaths, while psychoactive drug use caused 0.6 million deaths. Of the 2 million deaths attributed to alcohol use and the 0.4 million deaths attributed to drug use, it is worth noting that men were among the 2 million deaths attributed to alcohol use and the 0.4 million deaths attributed to drug use (Organization, 2024) . Because the harm of drugs extends beyond the addict to his family, society and the country, anti-drug units were established to limit their entry into the country. However, the policies adopted so far have not succeeded in reducing this problem that is troubling the world (2).

Therefore, countries have established anti-drug departments to curb this dangerous phenomenon. The most prominent functions of the Anti-Narcotics Department are combating and controlling the crimes of importing, exporting, cultivating, producing, possessing, acquiring, trading in, exchanging, transferring, or using narcotic substances in circumstances not authorized by law; combating illicit drug trafficking and public trafficking; and raiding criminal hotspots. Tightly controlling the circulation of precursors and chemicals, in coordination with relevant state agencies, to ensure they do not enter the illicit drug market; developing plans and taking measures to achieve this control locally and internationally; directing and coordinating the efforts of central and local agencies working in the field of anti-narcotics; implementing international anti-narcotics operations in conjunction with international anti-narcotics agencies; liaising with all government agencies involved in reducing the demand for narcotics to monitor difficulties and problems related to drug use and addiction, and contributing effectively to addressing them; coordinating with government agencies involved in reducing demand to confront unlicensed clinics or those that practice incorrect treatment frameworks and taking legal action in this regard; participating in studying addiction problems, preparing and analyzing relevant statistics, and monitoring the response of addicts. For treatment, contacting the competent authorities to provide care, coordinating with the Armed Forces, the Central Security Sector and various security directorates in preparing and implementing several annual campaigns to combat drug cultivation in rugged desert areas, monitoring illicit wealth obtained from drug crimes and taking legal action against the criminal elements involved in these activities as an effective method to combat drugs, technical supervision of anti-drug agencies in the security directorates and coordination with the National Security Sector regarding information received by the administration about illegal immigration elements, as well as human trafficking elements inside and outside the country, and following up on procedures for providing humanitarian and legal assistance to victims of human trafficking crimes, in cooperation with the relevant authorities. (Abdelradi, 2019). However, the research focused on the task of combating smuggling and possession as it is the main task.

Hence the importance of this research, which aims to use the Six Sigma scale to measure the performance quality of combating -Drugs Units across the country as a whole, and at each control center individually, and to compare the quality of performance across different centers. Although Six Sigma was designed to evaluate performance in manufacturing processes, it can also play a effective role in improving the effectiveness, efficiency, and accountability of drug enforcement units. Because it focuses on minimizing errors, improving processes, and using data to guide decision-making, it is well-suited to the operational challenges these units face, provided there are measurable deficiencies.

The objectives of the research are:

1. Measuring the performance quality of drug

control units across the country.
2. Measuring the performance quality across all drug control unit centers.
3. Comparing the performance quality between different units.
4. Determining the efficiency of each unit's performance.

Then, the country can assess the situation and make the necessary improvements for development, identifying the least performing centers, and focusing on them for reform. Since the Six Sigma metric is based on reducing the number of defects in a product, the study considered that drug offenses seized at the border before entering the country are considered sound products, while those that cross the border and are seized within are considered defective units.

2. MATERIAL AND METHODS

Six Sigma is defined as a quality improvement program that aims to reduce the number of defects in the production process to approximately 3.4 defects per million opportunities (3). It is also defined as a methodology that aims to accelerate the development process to produce a defect-free product (4). It is also defined as an approach or philosophy used to eliminate or reduce defects in processes and outputs in the organization (5).

The concepts upon which the standard is based can be summarized as follows [6]:

1. Unit: The product, service, or level of service to be studied.
2. Defective Units: Units that do not conform to one or more of the customers' requirements.

3. Defects per Unit (DPU): The sum of the defects for n defective units divided by the total number of units, i.e.:

$$\text{DPU} = \frac{\text{Number of defects}}{\text{number of units}} \dots\dots 1$$

4. Defect Opportunity: The number of potential defective opportunities in a unit. There can be multiple defective opportunities in a single unit.

5. Defects per Opportunity (DPO): This represents the percentage of defects in a single unit divided by the total number of defective opportunities, i.e.:

$$\text{DPO} = \frac{\text{DPU}}{\text{number of opportunities}} \dots\dots 2$$

6. Defects per Million Opportunities (DPMO): This represents the number of defects per opportunity multiplied by one million, i.e., as follows:

$$\text{DPMO} = \text{DPU} \times 10^6 \dots\dots 3$$

7. Defect-Free Yield (Y): This represents the units within specifications divided by the total number of units, i.e., as follows:

$$\text{Y} = \frac{\text{units satisfing standards}}{\text{Total number of units}} \dots\dots 4$$

Whereas units within specifications mean defect-free units.

8. Sigma Level:

The following formula is used to find the Sigma level:

$$\text{Sigma Quality Level} = 0.8406 + \sqrt{29.37 - 2.221 \times \ln(\text{DPMO})} \dots\dots 5$$

9. The value obtained from the equation above is then used to determine the Sigma level at which the specified facility operates, according to the following:

Table 1: The Relationship Between Sigma Levels and the Number of Defects Per Million Opportunities.

Sigma Level	DPMO	Process yield(Y) %
1	691.500	30.85
2	308.500	69.15
3	66.800	93.32
4	6.200	99.38
5	230	99.977
6	3.4	99.99966

3. APPLICATION

The scale 6-sigma was applied to hypothetical data due to the confidentiality of actual data. The data was divided into two groups, assuming there were two border regions (A and B) within the country. The performance quality of drug control units was measured across the country as a whole, and then for each region separately for comparison.

Table 2: Drugs Crimes in the Region A, Region B And the Whole Country / Month.

The period of time	Number of drugs smuggling crimes in region A	number of drugs smuggling crimes, which were not discoveredon time in region A	Number of drugs smuggling crimes in region B	Number of drugs possession crimes which were not discovered on time in region B	total number of crimes	total number of crimes that were not discoveredon the appropriate time in the country

January	18	5	180	36	198	41
February	20	7	130	38	150	44
March	16	7	146	42	162	48
April	14	5	140	32	154	36
May	12	5	122	42	134	46
June	22	11	148	56	170	69
July	24	10	156	66	180	76
August	18	8	156	66	174	74
September	14	7	142	38	156	44
October	10	5	130	42	140	46
November	12	4	118	32	130	36
December	14	6	112	40	126	46
Average	16	7	140	44	156	51

Table 3: Calculations Of Sigma Level for the Whole Country.

The period of time	The total number of the crimes	The number of drugs smuggling crimes, which were not discoveredon time	Defects in one Opportunity*	Defects in million Opportunities**	Level of Sigma***
January	198	41	0.207071	207070.7	2.3
February	150	44	0.293333	293333.3	2
March	162	48	0.296296	296296.3	2
April	154	36	0.233766	233766.2	2.2
May	134	46	0.343284	343283.6	1.9
June	170	69	0.405882	405882.4	1.7
July	180	76	0.422222	422222.2	1.6
August	174	74	0.425287	425287.4	1.6
September	156	44	0.282051	282051.3	2.1
October	140	46	0.328571	328571.4	1.9
November	130	36	0.276923	276923.1	2.1
December	126	46	0.365079	365079.4	1.8
Average	156	51	0.326923	326923.1	1.9

***By Applying Equation 1 **By Applying Equation 2 ***By Applying Equation 5**

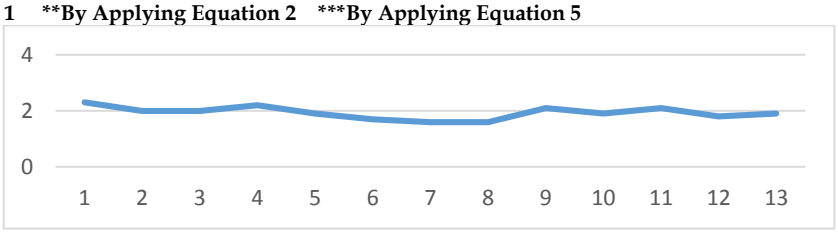

Figure 1: Sigma Level for the Whole Country\Month.

From the table 3, the best performance was in January, achieving a sigma of 2.3, meaning that the number of undetected crimes at that time was approximately 310 crimes out of every million crimes. The worst performance was in July and August, achieving a sigma of 1.6, meaning that there were approximately 500 undetected crimes out of every million crimes. Overall, we find that performance during the year achieved a sigma of 1.9, meaning that there were approximately 310 undetected crimes out of every million crimes. Figure 1 indicates that performance is similar throughout the months of the year.

Table 4: Calculations of Sigma Level for Region A.

time /month	Total Number of smuggling crimes	Number of smuggling crimes which were not discoveredon time	Defects per Opportunity*	Defects in a million chances **	Level of Sigma***
January	18	5	0.277778	277777.8	2.1
February	20	7	0.35	350000	1.8
March	16	7	0.4375	437500	1.6
April	14	5	0.357143	357142.9	1.8
May	12	5	0.416667	416666.7	1.6
June	22	11	0.5	500000	1.3
July	24	10	0.416667	416666.7	1.6
August	18	8	0.444444	444444.4	1.5
September	14	7	0.5	500000	1.3
October	10	5	0.5	500000	1.3
November	12	4	0.333333	333333.3	1.9

December	14	6	0.428571	428571.4	1.6
Average	16	7	0.4375	437500	1.6

***By Applying Equation 1 **By Applying Equation 2 ***By Applying Equation 5**

From the table 4 the best performance was in January where it achieved a sigma level of (2.1), meaning that the number of crimes that were not discovered at that time was approximately 309 crimes out of every million crimes. The worst performance was in June, September and October where the sigma was (1.3), meaning that there were approximately 600 crimes that were not discovered out of every million crimes. In general, we find that the performance during the year achieved a sigma of (1.6), meaning that there were approximately 500 crimes that were not discovered out of every million crimes

Table 5: Calculations Of Sigma Level for Region B.

Time /Month	Total Number of drugs possession crimes	Number of drugs possession crimes which were not discoveredon time	Defects per Opportunity*	Defects in a million chances**	Level of Sigma***
January	180	36	0.2	200000	2.3
February	130	38	0.292308	292307.7	2
March	146	42	0.287671	287671.2	2
April	140	32	0.228571	228571.4	2.2
May	122	42	0.344262	344262.3	1.9
June	148	56	0.378378	378378.4	1.8
July	156	66	0.423077	423076.9	1.6
August	156	66	0.423077	423076.9	1.6
September	142	38	0.267606	267605.6	2.1
October	130	42	0.323077	323076.9	1.9
November	118	32	0.271186	271186.4	2.1
December	112	40	0.357143	357142.9	1.8
Average	140	44	0.314286	314285.7	2

***By Applying Equation 1 **By Applying Equation 2 ***By Applying Equation 5**

From table 5 the best performance was in January, where it achieved a sigma level of (2.3), meaning that the number of crimes that were not discovered at that time was approximately 310 crimes out of every million crimes. The worst performance was in July and August, where the sigma was (1.6), meaning that there were approximately 500 crimes that were not discovered out of every million crimes. In general, we find that the performance during the year achieved a sigma of (2.0), meaning that there were approximately 308 crimes that were not discovered out of every million crimes.

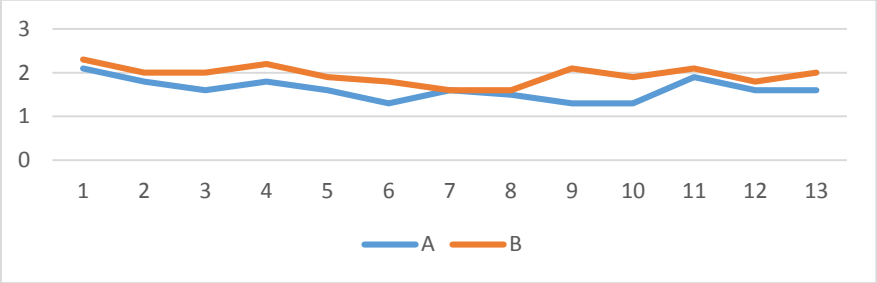

Figure 2: Sigma Level for the Two Areas a and B\Month.

Figure 2 indicates that the level of performance in combating drugs in the region B is better than the performance in the region A in all months except July, where it was equal. Referring to the tables 4 and 5, the sigma level during the year for region B was 2, meaning that there were approximately 308 crimes that were not discovered out of every million crimes and for region A was 1.6, meaning that there were approximately 500 crimes that were not discovered out of every million crimes

Table 6: Process Yield(Y) For the Region A, Region B And the Whole Country / Year.

	Process yield(Y) %*
The whole country	67%
Region A	56%
Region B	69%

***By Applying Equation 4**

Table 6 indicates the percentage of crimes that were detected at the time, i.e. the achievement percentage, as it indicates the achievement percentage for the region A 56%, for the region B

69%, and for the country as a whole 67%.

4. RESULTS

Referring to the previous analysis, the following results can be obtained:

1. The overall performance of combating -Drugs Units in this country is weak.
2. The performance level in both regions is weak, but performance in region B is better than that in region A.
3. The number of crimes not discovered in the country as a whole at the time is 310 out of every million crimes.
4. The overall achievement rate of combating - Drugs Units in the country is 67%.
5. The number of crimes not discovered in the region A is 500 out of every million crimes.
6. The overall achievement rate of combating - Drugs Units in the country is 56%.
7. The number of crimes not discovered in the time for the region B is 308 out of every million crimes.
8. The overall achievement rate of combating - Drugs Units in the country is 69%.

Recommendation: The methods currently used to combat drugs in this country need to be improved, by addition or by changing, and if the capabilities are weak, the focus should be on the region A.

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