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Green and Sustainable Chemistry in the Work of the United Nations Environment Programme: Results and Options for Future Regulation

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The expression of green and sustainable chemistry has gained significant attention around the world in recent years. Nowadays, it is evident that green and sustainable chemistry is necessary for Sustainable Development Goals (SDGs); however, the concept and its realisation seem quite vague. Until 2021, green and sustainable chemistry had been defined in different documents, which led to divergent practices. However, in 2021, the United Nations Environment Programme (UNEP) created a Framework Manual on Green and Sustainable Chemistry, which now serves as a uniform guidance for various stakeholders to realise innovation actions and assess management practices for green and sustainable chemistry. Despite its significance, the Framework Manual is not widely known, as it has hardly been analysed, and more seriously, its legal classification has not been examined so far. The aim of this paper is to fill this gap and analyse the Framework Manual from a regulatory viewpoint. In line with this, the study presents the main characteristics of the document, determines the correct legal classification of the document, and makes recommendations regarding the possible improvements of the document and the future regulating options for green and sustainable chemistry. By analysing these questions, the study arrives at significant results: Firstly, it declares that the Framework Manual is a legally non-binding, soft law document. Secondly, it identifies the advantages and disadvantages of soft law regulation. Thirdly, it concludes that the Framework Manual cannot be regarded as a final result. The topic of green and sustainable chemistry should be regulated in a legally binding form in the future. With these results, the study fills the huge gap in legal analysis of the Framework Manual and contributes to the satisfactory future regulation of green and sustainable chemistry.

1. Introduction

The concept of green and sustainable chemistry is extremely important nowadays due to its relation to the global sustainable development goals. This concept can be regarded as a precondition to achieve several SDGs, especially zero hunger (SDG 2), good health and well-being (SDG 3), clean water and sanitation (SDG 6), affordable and clean energy (SDG 7), sustainable consumption and production (SDG 12), and climate action (SDG 13). Besides these, green and sustainable chemistry may also indirectly contribute to other SDGs, such as decent working conditions, and economic growth (SDG 8), innovation and infrastructure (SDG 9), life below water (SDG 14), and life on land (SDG 15). Despite its significance, it seems an extremely difficult task to define green and sustainable chemistry, not to mention the difficulties regarding the determination of the necessary steps to realise the concept. The reason behind it is that the determination and the practice of green chemistry and sustainable chemistry are very heterogeneous.

The expression of green chemistry has been used for a long time, during which several documents have tried to give a definition for the concept. Besides the first concept and the 12 principles of green chemistry determined by Anastas and colleagues (Anastas et al., 2000), several other definitions can be found in the literature. For example, in 2009, Wilson and Schwarzman (2009) declared that green chemistry can be understood as the collection of the following: assessing the hazardous traits of the great majority of chemicals in commerce; controlling chemicals of significant concern; and motivating broad industry investment in cleaner chemical technologies and safer alternatives. Matus et al. (2012) stated that green chemistry helps to balance the need

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to improve the quality of life while maintaining the health of humans and the environment. They believed (Matus et al., 2012) that this concept uses scientific knowledge to reconcile a real need for chemical production with the desire to reduce the hazards associated with these activities. Shailaja and Priyanka (2021) came to the conclusion that green chemistry is a process through which we achieve safely manufactured drugs by eliminating hazardous chemicals.

The expression of sustainable chemistry was used at first as a synonym of green chemistry. However, in 2016, sustainable chemistry was acknowledged by the UN as one of the most important approaches for sound management of chemicals. In line with this, Blum et al. (2017) clearly distinguished sustainable chemistry from green chemistry and from operational safe use of chemicals, stating that sustainable chemistry is building on and goes beyond these two concepts. According to their definition, "sustainable chemistry is a holistic approach where the entire lifecycle of chemical products and the related system of actors, institutions, and culture is considered" (Blum et al., 2017). Similarly, Klaus Kümmerer (Kümmerer, 2017) stated that chemistry is sustainable if it contributes in a sustainable manner to sustainability and that sustainable chemistry is simultaneously both a path and a goal.

Due to the countless appearances and formulations surrounding the concept of both green chemistry and sustainable chemistry, the environment programme of the United Nations (UNEP) decided to start dealing with the topic of green and sustainable chemistry and to create a uniform document in connection with this question. Since the beginning of the work in 2019, UNEP has achieved several important results in this regard. The United Nations Environment Assembly (UNEA) has adopted several resolutions regarding the topic, and in 2021, a Framework Manual was also created on green and sustainable chemistry.

The above-mentioned documents and results achieved so far in connection with green and sustainable chemistry are significant. However, there are huge problems and gaps in knowledge in connection with them as well. First of all, the diversity of the definitions and expressions existing in connection with green and sustainable chemistry can be considered a significant problem from both a theoretical and a practical point of view. It does not promote uniformity and, more importantly, it makes it impossible to implement the concept. Without a clear definition and guide to practice, the idea of green and sustainable chemistry can never be achieved, and the SDGs connected to the concept also fail to be realised. The Framework Manual of UNEP would be a significant help in resolving this issue; however, the document is not widely known and has not been subject to comprehensive analysis so far. What is more, the legal status of the document has not yet been determined. Without a clear legal classification, it is also unclear how the document should be applied in practice. Due to the fact that the Framework Manual is a unique result and also the biggest success so far in connection with the topic of green and sustainable chemistry, this deficiency definitely requires remedy. The purpose of this study is to accomplish this task and provide a comprehensive analysis of the Framework Manual from a regulatory viewpoint. Within this purpose, the study clarifies the legal classification of the document and analyses the type of regulation implemented in the document. In connection with these issues, the study answers the following research questions: How and where was the Framework Manual created, and what is the aim and the main content of the document? What is the correct legal classification of the document, and what are the characteristics, the advantages and the disadvantages of this form of regulation? Is the Framework Manual a satisfying final result or not? How and in what form should the concept of green and sustainable chemistry be regulated in the future? In order to answer these questions, the study uses qualitative research methods and processes relevant literature sources and the content of the Framework Manual using descriptive and analytical methods. With this analysis, the study aims to promote widespread awareness, application and improvement of the Framework Manual, contributing to the effective future regulation and implementation of the concept of green and sustainable chemistry.

2. The Framework Manual on Green and Sustainable Chemistry

The topic of green and sustainable chemistry has been on the agenda of the United Nations Environment Programme since 2019 due to the fact that UNEP has seen the lack of clarity of the concept of green and sustainable chemistry and the lack of uniform practice to achieve that. During its work, UNEP realised that it is a challenging task to identify the best practices regarding green and sustainable chemistry, given the absence of common assessment criteria and the broad understanding of sustainable chemistry (UNEP, 2021). In order to solve these problems, it was decided that a Framework Manual would be created on green and sustainable chemistry, which was declared in Resolution 4/8 on Sound Management of Chemicals and Waste of UNEA in 2019. The resolution "requested the Executive Director to synthesise UNEP's analysis of best practices in sustainable chemistry into manuals on green and sustainable chemistry, in consultation with relevant stakeholders" – UNEA Resolution 4/8 (UNEP, 2019). It was decided that the Manual will be a result of a wide consultation with experts from industry, academia, government, international organisations and NGOs. The aim of the Manual was also determined: to facilitate the understanding of green and sustainable chemistry and to

provide guidance to states and stakeholders for advancing this concept (UNEP, 2021). In line with this objective, the Manual harmonises different views and interests, which makes it a high-level overview of various scientific, technical and policy aspects of green and sustainable chemistry. More precisely, the Manual concentrates on three main questions: What is green and sustainable chemistry, and what does it aim to achieve? Why is green and sustainable chemistry needed? How is it possible to achieve green and sustainable chemistry? In order to answer these questions, the Manual deals with the topic of green and sustainable chemistry throughout 8 chapters. After the Introduction, Chapter 2 of the Manual discusses challenges and opportunities of chemistry in achieving the 2030 Sustainable Development Agenda. Chapter 3, as the most important part of the document, defines 10 objectives (Figure 1) and guiding considerations for green and sustainable chemistry.

Figure 1: Objectives for Green and Sustainable Chemistry (UNEP, 2021)

After identifying these objectives, Chapters 4-7 deal with the question of how to achieve these objectives. In line with this, Chapter 4 presents scientific dimensions of green and sustainable chemistry, Chapter 5 contains principles for enabling instruments and policies, Chapter 6 sets out principles for enabling sectors and programmes, and Chapter 7 contains the necessary metrics, assessment and reporting.
It can be seen from the above that, based on its content, the Manual can be identified as the most important summary and guide created so far regarding the topic of green and sustainable chemistry. It collects huge amounts of data, practice and answers questions that no document has been able to do so far. Based on this, its significance is unquestionable. However, the Manual has a huge disadvantage as well: it is not a legally binding document. Based on the creation process, the title and mainly the content of the Manual, it can only be categorised as a soft law document, which means that it does not have a legally binding nature. The document does not contain any strict regulations or exact rights and obligations. It only contains principles and objectives. For example, it clearly declares in the introduction that it only wants to provide guidance and that its application is only encouraged, not obligatory (UNEP, 2021).
After the determination of the legal status of the Manual, the next chapter will present the characteristics of soft law documents, from which it will be clear why UNEP has chosen this kind of document and what the advantages are of this decision. Besides this, the disadvantages of soft law documents will also be discussed, from which it will be seen whether the Framework Manual can be regarded as a final result to regulate green and sustainable chemistry or not.

3. The characteristics of soft law documents

Soft law instruments are legally non-binding documents which aim to generally establish standards and principles for a particular activity or concept. Although it is not possible to provide a totally clear definition, the category of soft law most likely includes documents that have some legal relevance but do not appear in the form of a legal source and also those documents that appear in the form of a source of law, but which – because of their generality, vagueness or subjectivity – cannot be invoked or enforced. The most typical examples of soft law include memoranda of understanding; certain UN General Assembly (UN GA) resolutions, which do not have the status of customary law; various directives, principles, guidelines, declarations, recommendations, programmes, and codes of conduct (Kolb, 2016). These documents are important tools in the hands of the parties, a large number of soft law documents are created every year (Aust, 2010).
The soft law nature of a certain document can usually be established based on the content of the document. In the case of non-binding soft law documents, terms referring to the existence of binding force – including the words “to subject”, “subjection”, “right”, “obliged” or “obligation” – are usually omitted (Aust, 2010) and replaced with words such as “to aspire”, “endeavour”, “to intend” or “intention” (Klabbers, 2013). In the Framework Manual, several examples can be found for these latter expressions, e.g., “to encourage”, “to provide guidance”, “to give objectives” (UNEP, 2021). Soft law documents have several advantages, including those presented in Table 1.

Table 1: Advantages of soft law documents

Advantages	Explanation
1. Soft law documents are easy to create	There are no exact requirements regarding the creation of soft law material; there is practically complete freedom in the drafting of such documents. As a result, the creation of soft law materials is usually easy and quick.
2. Soft law documents provide flexible solutions	Due to the easy and fast creation process, soft law documents can undoubtedly provide a flexible solution to issues that require urgent action, and they can help to adapt to new situations and technological developments (Walter et al., 2011).
3. Soft law documents are easily accepted	As they do not contain strict rights and obligations, soft law documents are easily accepted by states and other entities.
4. Soft law documents are easy to modify	Not only the creation, but also the modification of soft law documents is easy and fast, which may be useful in case of a rapidly changing area or issue.
5. Soft law documents do not need to be registered	No incorporation or registration is required for soft law material, which is also part of their easy creation process.
6. Soft law documents can be applied by several actors	Soft law documents can be accepted and applied by a wide range of actors. Thus, they can be a solution in case of issues involving many entities that are very different from each other.
7. Soft law documents have several useful functions: 1) Soft law can give guidance on how to interpret and implement existing regulations, e.g. treaty provisions. 2) Soft law may represent the beginning of a process leading to an international treaty. 3) soft law may contribute to the formation of customary law; and 4) Soft law may be declaratory of existing unwritten rules.	Soft law material relating to a treaty can be considered as an expression of subsequent practice in the application of the treaty and should be taken into account in the interpretation of the treaty. Soft law can serve as a basis for binding standards in the future and function as a basis for law-making. For example, widely adopted and implemented non-binding technical standards, guidelines, and other resolutions can be cited as evidence of customary international law.

Based on these advantages, it is understandable why UNEP has chosen the type of soft law and decided to create a Framework Manual on the topic of green and sustainable chemistry. In this decision, the following arguments could be important. Green and sustainable chemistry was not clearly defined earlier, and there was a quite urgent need for the creation of a document that can be a starting point and a helpful tool in defining and realising this concept. Due to this, it was impossible to wait for the long process of concluding, for example, an international treaty. It was much faster and easier to create a soft law document and apply it in practice as soon as it is ready. Green and Sustainable Chemistry is not a static topic. On the contrary, it forms a rapidly changing and developing area on the basis of new results and improvements. Based on this, a document is needed, which can be easily modified if necessary. In addition, by choosing this soft law type, it was possible to invite several actors to the creation process. As the Manual itself declares, it targets „a range of audiences and stakeholders concerned with the sound management of chemicals and waste, as well as innovation for green and sustainable chemistry and sustainable product development." (UNEP, 2021). These actors include state authorities, educational, academic and research institutions, private sector entities, consumers, civil society organisations, citizens and the public at large. The invitation of these heterogeneous actors would not have been possible with any other type of document. Besides the advantages, it is worth paying attention to the difficulties and disadvantages of soft law documents (Table 2) as well.

4. The possibilities for future regulation of green and sustainable chemistry

After the examination of the advantages and disadvantages of soft law documents, it can be established that the Manual is a good starting point. However, it cannot be regarded as a final result. On the contrary, the Manual should be improved or replaced in the future. In connection with this, two options can be mentioned, which also serve as possibilities for future regulation of green and sustainable chemistry.

Table 2: Disadvantages of soft law documents

Disadvantages	Explanation
1. Soft law documents are not legally binding	As it was already mentioned, soft law documents do not contain exact rights and obligations. Based on this, the entities can comply with or ignore the content of these materials according to their needs and will. It also means that the entities are under no formal obligation to comply with soft law. They are free to choose to violate or ignore it.
2. Soft law documents lack the possibility of enforcement	Due to their non-binding nature, soft law documents can not be enforced. It means that the modest enforcement mechanisms of international law are not applicable to them. For example, disregarding soft law must not entail countermeasures (reprisals), and soft law documents cannot be invoked before UN bodies (Schmalenbach, 2018). Ignoring soft law does not give rise to international responsibility (Walter et al., 2011).
3. Soft law documents are not clear and precise enough	As it was mentioned, soft law documents usually contain principles and objectives, which also means that their content is not precise and sometimes not clear enough, as their aim is only to give a theoretical framework or starting point in connection with a certain issue.

1. The creation of an international treaty: The first possibility is that the Manual becomes an international treaty or forms the basis of a future international treaty regulating green and sustainable chemistry. In order to do that, the intention of the international community is necessary. More precisely, those entities can move in this direction which have the capacity to conclude international treaties. These entities definitely include states and international organisations, which thus can decide to accept the Manual as a legally binding international treaty or to use its content, as a whole or partially, to conclude an international treaty. Both ways make it necessary to apply the rules of the law of treaties, which means, among others, that the states and/or international organisations have to express their consent to be bound by the treaty. This can be realised in several ways, including e.g. signature, ratification or acceptance. However, the conclusion of a treaty does not only make it necessary to follow a formal process, it is also necessary to set out specific rights and obligations. It means that the content of the Manual should be made much more specific, ensuring that its provisions are enforceable with the help of international law.
2. Formulation of customary international law: The second possibility is that the Manual gains customary law status and becomes binding as customary international law. For this result, two conditions are necessary: 1) the general and consistent practice of states (or perhaps international organisations) and 2) the so-called opinio iuris sive necessitates (Walter et al., 2011). For the first condition, the general and consistent practice means that most states (or perhaps international organisations) realise the same activity in connection with a certain issue. For example, if they use the Manual, apply it in practice and invoke it several times, they can fulfil one condition of customary international law. In connection with this, the time factor is also relevant; however, it is important to highlight that, given a sufficiently large number of representative practices pointing in the same direction, it does not necessarily take a long time for customary law to develop. As for the second condition, the opinio iuris sive necessitatis requirement means that states (or perhaps international organisations) must regard a given practice as a legal obligation and follow it accordingly. Generally speaking, if the entities establish rights and obligations on a particular practice and enforce them, for example, before international courts, the condition of opinio iuris can be established (Klabbers, 2013). Consequently, if a soft law document is applied generally and consistently in practice and is regarded as law, then the document acquires customary law status and becomes legally binding. According to Fabio Tronchetti, this is why soft law documents should not be underestimated, as they can become customary law, binding for states, as it has already been the case for a number of UN General Assembly resolutions (Walter et al., 2011).
Both the above options can serve as a future possibility for regulating green and sustainable chemistry in a legally binding, enforceable way. It is true that both the creation of an international treaty and the formulation of customary international law take a lot of time; however, the significance of green and sustainable chemistry justifies to the utmost that its regulation should take place in one of the aforementioned forms in the future.

5. Conclusion

The paper revealed that the topic of green and sustainable chemistry has gone through a significant development in the work of UNEP. The long and persistent work of the organ resulted in the creation of the Framework Manual, which is the most important document created on green and sustainable chemistry so far. Based on its content, the Manual is an extremely useful tool in defining and realising green and sustainable

chemistry as it defines the main objectives and provides the necessary metrics to achieve the purpose. Besides paying attention to the creation process and significance of the Manual, the study analysed its legal status in detail, which can be considered as an important gap-filling result and a significant novelty. The legal classification of the document has not yet been presented, nor have the advantages and the disadvantages of the soft law nature of the Manual. Based on the findings of the study, it can be declared that soft law documents have several advantages: with their help of, it is possible to lay down principles of interpretation or forms of conduct without strict requirements. Due to the easy way of creation, soft law might be useful, or even necessary and desirable in certain cases, especially when an urgent action is needed. Thus, the category of soft law can undoubtedly help to adapt to new situations and technological developments very quickly and easily. Based on this, in some situations, soft law can be preferable to a legally binding document. However, from the study, it can also be seen that soft law documents should not be seen as the final stage of the legislative process. It would be more appropriate to consider soft law as a starting point or an intermediate step. Soft law documents can be an excellent stopgap solution in situations where it is not possible to wait for a binding norm due to time constraints or other circumstances. However, members of the international community should continue to favour transparent, legally binding regulatory approaches. The author of this study also believes that the usage of soft law documents should only serve as an exceptional stopgap solution and not a final method of legislation.

In line with this, UNEP should continue with the work on the topic of green and sustainable chemistry and work for an enforceable, legally binding regulation. As the study revealed, two ways exist in order to do that: 1) to conclude an international treaty, 2) to fulfil the conditions of customary international law. None of these possibilities is easy; however, one of them is definitely necessary to regulate the topic of green and sustainable chemistry in a satisfactory way. Without satisfactory regulation, neither green and sustainable chemistry nor the SDGs mentioned in the introduction can be realised. Therefore, considering and implementing the options set out in the study is a priority for the future of sustainable development. Based on this, the results of the study can and should be used in the future to improve the Framework Manual and to achieve effective future regulation and implementation of the concept of green and sustainable chemistry.

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