# Cybernetics: A Transformative Platform in Achieving G20 SDS

**Mehboob Zahedi,** Department of Computer Science and Engineering, Aliah University
**Abhishek Das,** Department of Computer Science and Engineering, Aliah University

## ABSTRACT

This century has faced many modern problems i.e. how to fulfil the quality food, how to secure the data, how to increase the food productivity, how to reduce the labor cost, how to improve technological enhancement with less interference etc. Thus we need some technology which can be operated by self or give solution by itself. These may be considered as some kind of Autonomous technology for Sustainable Development Sectors (SDSs). Following this path, a model has been proposed which is based on mathematical approach, theoretical system like controlling some devices, named as Cybernetics. It is used in many different fields like: military, aerospace, robotics, medical, vehicles etc. Cybernetic is able to adapt the human control over the device such that it can consummate good feedback by getting robustness and good performance of the system. There are several modern applications available in the current times but Cybernetics will still carry forward for the next decade. This paper is about the control and necessity of cybernetics that how it gives us the electronic facilities in an efficient way. It is also used for detecting, scanning and analyzing the system as well. The essence of the Cybernetics approach is to understand the functions and processes of systems capable of receiving storing and processing information and then using it for its own control.

**Keywords: G20, Cybernetics, Autonomous Technology, Cybernetic Transportation System (cts), Control System, Sustainable Development Sectors (sdss).**

## 1. Introduction:

The G20 or Group of Twenty Nations work, in addition to its core economic mandate, encompasses action on key global social and environmental challenges, contributing to the provision of global public goods and supporting the integration of low-income and developing countries into a sustainable global economy. The G20 comprising 19 countries and the European Union has collectively contributed to Sustainable Development Sectors (SDS) defined in the Action Plan and at the G20's current priorities across the three dimensions of sustainable development – economic, social and environmental while also examining how the G20's work on cross-cutting issues such as gender equality is helping to deliver results [25]. Actions mandated by the G20 in support of the global goals have increased in quantitative terms since the adoption of the G20's 2030 Action Plan. The G20 has put particular emphasis on the sustainable use of natural resources with focus on water in 2017, soils in 2018, innovation in 2019. The G20 aligned its goal with the 2030 Agenda's to reduce to less than 3% the cost of remittances and to eliminate remittance corridors with costs higher than 5%. Achieving this goal would, at a minimum, generate an extra USD 25 billion per year by 2030 [25].

Cybernetics is the study which is able to control and communicate between human and machine [15] [17]. It focuses on how a system processing the data, responding to it, changing for better desired functioning using the previous feedback [18]. It is currently imposed on scientific field also i.e. applied statistics [4]. The Viable System Models (VSM) are now capable to manage the complex system in a dynamic way by its enhancing situations using cybernetics [1] [2] [20]. It is also focus on enhancing the natural systems such that they can have their own objectives instead of controlling by the human. We should impose the study of cybernetics such that it can reduce the manual control as well as the compensatory behavior. For the advancement of the theory, tools and models, we need a research effort which contains some target goals. In that research, it contains some questions,

I. How to use the preliminary study of the future task constraints?

II. What are the factors and methods that can operate the adjustment or adaptation?

III. What is the scale of human adjustment in variable situation?

IV. What are the control theories and techniques that can identify the system and help to know the time varying and non-linear manual control?

This paper will contain a brief knowledge about the cybernetics with its fundamentals, classical control theories, problems and its solutions, applications etc. It will give a brief knowledge about the cybernetics and its frameworks. It also includes the limitations, implications, findings as well as the purpose of Cybernetics. Overall, it will make an optimal opportunity to get knowledge about the cybernetics such that anyone can get a brief understanding easily from this article. It focuses on how system uses the information for its process, controlling the system actions, models etc. It can be applied on any kind of physical, biological and technological model easily in a reasonable manner. Cybernetics is mainly specified as the goal directed models and functional systems that have the control relation.

## 2. Discussion:

Cybernetics is the combinations of Information theory, control theory, mathematical communication theory, General system theory and system analysis, Artificial intelligence (AI), optimization, operation research, Data analysis and decision making. It is based on the understanding the objective to the emergence of self [16]. The first order cybernetics is for the observed system and the second order cybernetics is for the observing systems [18]. The second order cybernetics contains self-organization, autopoeisis, recursiveness, cognition and reflexion [15] [28].
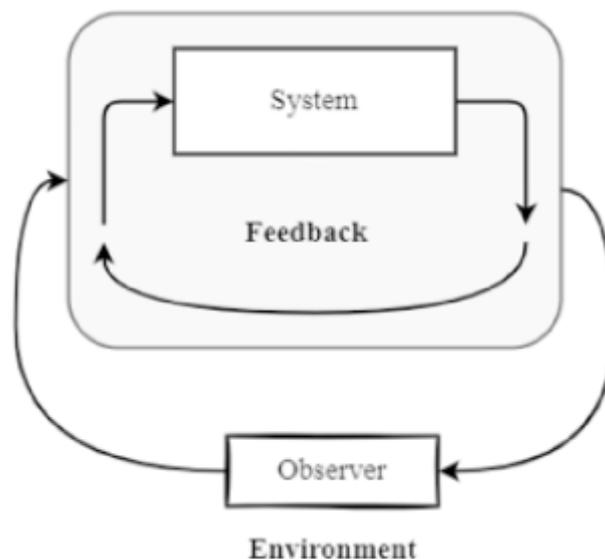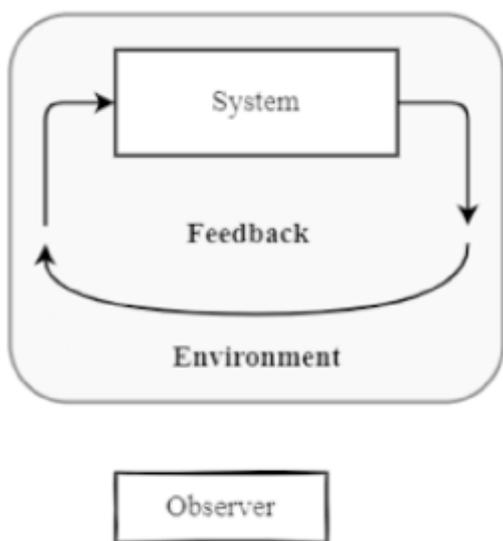




**Fig.1:** First-order Cybernetics (Left) and Second-order Cybernetics (Right), illustration by Zihao Zhang [23]

## 3. Applications:

Nowadays the most demanding developments are the systems which is the complex and adaptive system growth, including the power of modern stimulated computer system [12] [15]. It is developed for the ease our life rather than the unusable profit of greedy people [3]. There are several applications of Cybernetics i.e.

### I. Service System:

In this century, this sector is increasing day by day with the help of a large number of workers in the industry. It has massive amount of industries including agriculture, mining, manufacturing etc. From the SDGs number 1 and 2, we all know there should not be any poverty exist with zero hunger. According to these goals, we have to develop the service system for the peoples help. With the help of modern tools like: internet, cybernetics, information technology, computer etc., we can enhance this sector and services rapidly for economic growth. As a result, these can illustrate the working approach and analyze the system for a different service owner. The previous classical services are based on the pre-planned decision rules. But the modern services are based upon the real time analysis and adaptively [21].

### II. Infrastructure and transportation system:

The rapid increasing population and vehicles are very difficult to manage on the real time scenario. For achieving the Sustainable Development Goals (SDGs), we need to target the zero environmental

impact due to the vehicles and engines [24]. In the SDG goals number 9 (nine), 11 (eleven), 13 (thirteen) out of 17 (seventeen) goals tell us about the infrastructural innovation, the sustainable development of cities as well as the climate safety. For that purpose, we need some kind of Cybernetic Transportation System (CTS) or Intelligent Transportation System (ITS) by which we can resolve those problems efficiently [8]. Cybernetics is embedded on this sector (like: airport, vehicles, roads, bridges etc.) with the traffic sensor, emergency signal and traffic control. Its main objective is to provide safety, organizing vehicles on the urban areas, rapid transportation growth etc. It can evaluate the sensors information for managing transport by using the control algorithms in different real time situation.

## III. Environmental and Energy Systems:

We all know that from the SDGs number 7, 13 and 16 that we have to provide the clean energy, to look after the climate and to give human a peaceful place with its human rights. On earth, the biological life is mainly classified into two categories i.e. plant life and animal life. Both of us live within this environment since 65 million years. We all know that water, atmosphere and land are main three components in the environment on which the whole biological system is dependent. This biological system is affected and grinded by the most of the transportation vehicles and industries which emit the dangerous gases in the form of energies. Cybernetics classified the system into the mathematical form for quantitative analysis of the biological environment. Such that it could be understandable the methodological generalization of environment components functioning of the complex system [14]. It makes a practical awareness of maintaining the environment in the form of complex system with multi functioning abilities. It also helps in the agriculture of Cyber Physical Social System (CPSS) which provides to manage the production on the solar greenhouse [13].

## IV. Sustainable Systems:

The increasing human population in the world is going to the way of scarcity of resources in the nature. The resources i.e. water, metal, minerals, agricultural land etc. are continuously devoured by the human [21]. There is a huge interconnected and complex problem which is affecting our environment continuously. The main question in this, "Can we make our planet sustainable for future generation?" So it's our duty to make a balance between the society and environment by the sustainable relationship.

Such that there will be an imaginary limitation or boundary of the utilization of the earth's resources. By this, the human activities on the environment can be reduced. For the modernization and industrialization, we need the heating system for cooking, agriculture, transportation, lighting, industry etc. So, there are some human design and cybernetics systems which produce the energy to assure the energy demand of many complex systems or vehicles such that we can reduce the pollution in the environment and make a sustainable society. It is used to make the society sustainable in an efficient and effective way rather than the conventional method.

## V. Defense and Space Systems:

Since the last years, there are many major changes happened in the defense as well as the space systems. We need a well-managed and complex military system to give the required equipment to the armed forces for defense. When any country plans to impose any military campaign, they have to keep in mind the life process of the entire event occurrences such that it can work with a structured and organized way. A scientist named as Weiner, gave his precious lifetime to make it autonomous such that it could change its position according to the enemies. But at the initial age, the tests were mostly unsuccessful. But this research helped the armed force to make the feedback systems, communication as well as the control systems which had been turned into the Cybernetics system later. It gave the anti-aircraft guns for automatically shooting down of the enemies plans [10]. We got the credible response of bombers using the cybernetics. Thus using this, we had created the world's first computer network system named Semi-Automatic Ground Environment (SAGE) [11]. Now this SAGE is helping us to launch the ballistic missiles as well. The stability, durability and flexibility properties of the network and radar had been maintained with the idea of cybernetics [5].

## VI. Cyber Security:

Nowadays the computer security and cybernetics are very much necessary with growing phase of research in our modern age [9]. In SDGs 16, we have noticed we have to live in the society in a peaceful and justice manner. Initially it is created for the regulated system for the system stability [22]. It includes the procedures, training, security policies, risk management etc. There may be various attacks like: malicious scripts and codes, virus, malware, spam, vulnerability, unauthorized access etc. To protect the system or network from the cyber threats, there are

few elements in system needs to fulfill the integrity, availability, non-repudiation, confidentiality, authenticity. There are also few techniques of authorization person or identifying person by the data encryption, authentication and access control.

## VII. Communication and Control:

Communication is an important part in our modern day life by expressing ideas, acquiring knowledge, transferring knowledge etc. For achieving the SDGs 17 that is making the good partnership between everyone to achieve all the SDG goals. That will not be possible if there is any gap in the communication between countries. It is connected through a chain between two or more communicators. Most of the organization fail or face the problems because of the less communication to the employ so that they don't get things crystal clear [7]. In every aspect of life, we need an appropriate, meaningful, understandable and effective communicating path. Because of the different background knowledge, there may be occurred an inconsistency and incomprehensible when a business man will meet an IT man during some professional work. So, Cybernetics can face the problem with understanding its arguments.
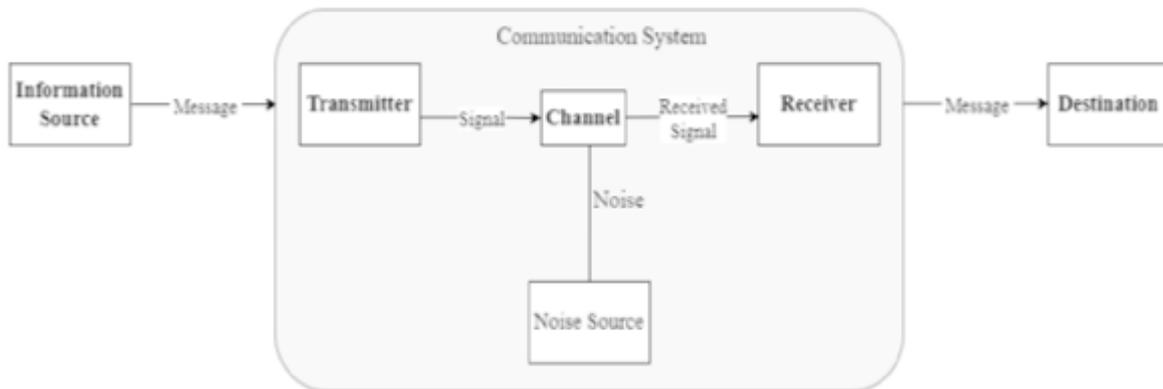


**Fig.2:** Communication Process Model [6]

### VIII. Feedback System:

All the sector of technologies and business must need a feedback system to manage successfully.
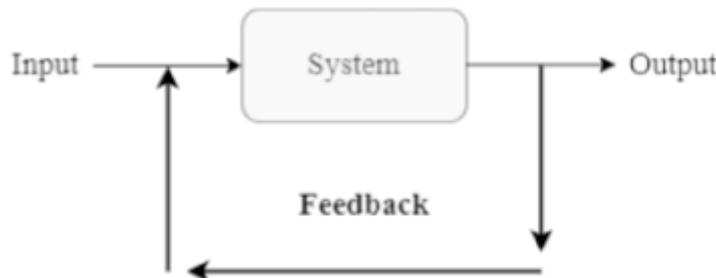


**Fig.3**: Feedback system

Nowadays computers are connected to the internet and it provides some extraordinary tools and powerful search engines to all the information for internal as well as the external analysis. Thus, internet is a complex and powerful feedback system. It can improve the financial and technical part of any sector. Using the cybernetics, artificial intelligence and machine learning, we can predict the customer interests, buying things pattern, market prediction, target audience etc.

### I. Science and Technology:

In the technical manufacturing sector, safety and security are very much needed so there are different type of safety systems available. In 1970, a scientist Hodge had proposed an educational model which gives a simple and understandable stream of educational process in any organization [19]. Using the cybernetics, we can separate the physical and biological systems. This scenario is very much helpful in the science field. It can also provide the

complex and probabilistic systems in the technical field which can enhance our life in an efficient way.

## 4. Conclusion:

To achieve all the 17 SDG goals and 169 targets, we need to give our 100% effort in the society such that our future generation can be benefited. All the targets need to be fulfilled by 2030. This paper includes all the possibilities to gain the SDGs with respect to the Cybernetics. Cybernetics has the ability to optimize complex problems, enhancing the AI, mathematical communication theory, control theory, information theory, data analysis and decision making etc. It provides the feedback system for enhancing the defense sector and technologies. It also helps us in various and efficient way to get the targets with time. This paper also contains the applications of cybernetics, how it has been implemented to reduce zero hunger, no poverty, no pollution etc. Hence, it's our responsibility to participate in this noble purpose. Cybernetics can create the systems of the ecological view during the war time as well as the post war time. It has a large contribution in the communication channel, AI, observing the animals, management science, social science, radar, aircraft etc. All the automated and self-observing tools or systems are used the cybernetics for enhancing its application and accuracy. Cybernetics helps us to use the complex systems in an efficient way. We have noticed that cybernetics has a wide applications in our society for achieving the SDGs.

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