Chapter 4

Governance of Healthcare Technology
Emerging Global Policy Discourse

4.1: Introduction

The previous three chapters have taken account of diffusion of healthcare technology, the process of medicalization and evolution of clinical gaze of the medical profession empowering them to practice social control over population. It has been argued with empirical data drawn from available publications that evolution of medical science to a dominant model of political economy has created in-equality of access and also rendered healthcare services as a domain of profit seeking behaviour. Apart from these concerns of healthcare technology, the last chapter has also reflected on iatrogenesis of technologically driven medicine.

The present chapter will comprehensively debate the issues related to governance of healthcare technology. The general meaning conveyed by the umbrella term ‘Healthcare technology’ is very broad where it includes various medical devices, procedures and techniques that are used to enhance person’s state of physical, mental or social well being. Central to the idea of healthcare technology is the definition of medical devices which include an instrument, apparatus or machine used to prevent, diagnose or treat disease. It also serves to detect, measure or restore or modify structure or function of body for a given health purpose. The present chapter will minimise the discussions on healthcare technology governance to the subset of medical devices. The discussion on governance will transcend the neo-liberal notion of accountability and transparency etc. in the process of implementation and will bring in issues of policy too.

First of all, this chapter will summarize the relevant terms and schemes in regard to classifications of medical devices, followed by a broad overview of the process of governance of medical devices in the developed world. As per the World Health Organisation estimate, in 2010, the global medical devices market was worth US$ 164 billion and grew faster than the global market for medicines\(^1\). The document further projects that it will reach US$ 228 billion by 2015\(^2\). The largest regional market was in the Americas (representing
45% of global sales revenue), followed by Europe (31%) and Asia (21%), while the Middle East and Africa represent a combined 3% of sales revenue. The present chapter will limit its enquiry to specific models of governance in the USA, EU, Japan considering the fact that these three economies dominate the total business of medical devices. Governance of healthcare technology in India and Assam respectively will be taken up in the next two chapters.

This chapter, however, starts with the issue of governability of medical devices itself, drawing insights from Michel Foucault’s arguments.

4.2: Foucault’s Notion of Governmentality and Contemporary Debates on Governance

Throughout his work on power, Michel Foucault explored ways in which humans have been made subjects throughout history. Foucault described more regimented power structure of the king, judiciary and also the structure of subtle power of knowledge. Though Foucault did not directly concern himself with the questions of governance, a very close concept of “governmentality” was introduced in his lectures in college de France. In the words of Foucault, ‘By this word “governmentality” I mean three things. First, by “governmentality” I understand the ensemble formed by institutions, procedures, analyses and reflections, calculations, and tactics that allow the exercise of this very specific, albeit very complex, power that has the population as its target, political economy as its major form of knowledge, and apparatuses of security as its essential technical instrument. Second, by “governmentality” I understand the tendency, the line of force, that for a long time, and throughout the West, has constantly led towards the pre-eminence over all other types of power – sovereignty, discipline, and so on – of the type of power that we can call “government” and which has led to the development of a series of specific governmental apparatuses (appareils) on the one hand, and, on the other to the development of a series of knowledge (savoirs). Finally by “governmentality” I think we should understand the process, or rather, the result of the process by which the state of justice of the Middle Ages became the administrative state in the fifteenth and sixteenth centuries and was gradually “governmentalized.”

As has been outlined in Chapter 1, the present study focuses on policies, institutions and practices while capturing the framework of governance. Policies are of important significance as under the current neo-liberal era, the policies are almost taken as foregone conclusion and the IMF-World Bank model of governance is accepted as granted. However, the focus on
political economy of technology constantly reminds us to question the policies itself, apart from institutions and practices as policies may itself lay down different modes of governance.

Governance is best understood as a concept that allows us to discuss the role of government in coping with public issues and the contribution that other players may make. A very clear distinction between governance and government must be spelled out here. It is commonplace to see that any debate or problem of "governance” becomes responsibility of “government”, with the corollary that former is a function of the latter. The present study argues this is not the correct view and it need to stress on the question - If governance is not about government, what is it about? Partly governance is about how governments and other stakeholders or organization interact, how they relate to citizens, and how decisions are taken in a complex world.

Governance needs to be understood as a process where in societies or organizations arrive at their important decisions. It is a process where stakeholders are identified and involved to bring in accountability. Since a process itself is hard to observe, researchers of governance tend to pin their attention on the governance system or framework upon which the entire process rests - that is the policies, practices, institutions and infrastructure. This framework of governance determines who gets power, how decisions are taken and how accountability is rendered. This is the point of convergence of Foucault’s perspective of govermentality with modern concept of governance.

Governance mechanism can exist in many levels and the participation of stakeholders may not be uniform. In simpler terms governance is about the strategic aspects of steering to deliver greater good to the ones being governed. It is understood that governance is not only about where to go, but also about who should be involved in deciding, and in what capacity. Governance might operate at global, national, community or organizational level.

If one looks at the facets of good governance it is often difficult and controversial to identify the basic principles. The United Nations Development Program (UNDP “Governance and Sustainable Human Development, 1997) suggested a set of principles that, with slight variations, appear in much of the literature. There is strong evidence that these UNDP proposed principles have a claim to universal recognition. Of the five principles, ‘Legitimacy
and Voice’ and ‘Fairness’ have the strongest claim to universal recognition based on over a half century of UN accomplishments in the field of human rights.

Whether or not institutions of governance are legitimate—and whether they are also perceived to be so—is a matter of great importance. The perception of legitimacy of institutions is of paramount importance since the very survival of such institution in the era of multiple stakeholders will be guaranteed only when public sees legitimacy in them.6 In our area of enquiry of medical device governance legitimacy as seen by the different national governments is a very crucial issue. Unless institutions of global governance are seen as legitimate entity by various national governments achieving this desired outcome will be impossible. Global or international governance institutions may promulgate international, trans-border co-operation and may help formulating regulatory frameworks.

4.3: Challenge of Pluralism in Governance of Health Technology

Governance of health may be viewed as pluralistic authority spheres and networks. Multitude of forces interact in a complex adaptive system of healthcare to generate the outcome. Health care technology governance aptly fits to the concept of plurality of participation. The stakeholders for health technology issues now extends far beyond any government. It includes: private or commercial entities (multinational corporations); academia; non-governmental organizations such as private foundations, humanitarian groups, and advocacy organizations; multilateral organizations such as the World Health Organization (WHO), the World Bank, and the U.N. development agencies; and bilateral aid structures such as the U.S. Agency for International Development, the Swedish International Development Agency, and the Japan International Cooperation Agency etc. Owing to the multitude of players, a state-centric approach to regulation of health care delivery is inadequate for today’s public health challenges7.

For deeper penetration into the domains of governance of healthcare technologies, one has to review globally prevailing standards of regulation and practices, as health technology in itself is a globalised issue. Global governance is a highly contested idea. The 1995 "Report of the Commission on Global Governance" took governance to be "the sum of the many ways in which individuals and institutions, public and private, manage their common affairs"8. While developing our concept of power, we need to view governance as "polyarchy" wherein a
multiplicity of agencies with authority and influence now co-exist. Though the political sovereign authority of any single state is never absolute, in general terms the authority of state is prioritised over non-state actors. The processes of globalisation and a plurality of actors have led to certain changes where various stakeholders share the table, in deciding how decisions will be made.

Authority of the regulator has two critical elements: permission to make the rules and ensuring compliance with those rules. With a wider spread of authority, the actual patterns of authority vary according to the issue and the particular constituency. As Rosenau has noted, authority no longer automatically results from the particular status of an actor but arises from relationships within "spheres of authority".9

A useful model has been proposed to display the complexity of governance in today’s world by David Fidler10. Importantly the model differentiates international from global-international agreements occur between nations, and global interactions include all the other non-state and multinational organizations. David Fidler has commented that legal system is at the heart of Global governance. Fiddler asserted strong legal and structural framework in global health is increasingly important given the state of prevailing chaos in regulating global health concerns. The question of governing technology from an international or global perspective is strengthened by this argument. Any set of governance that will protect the interest of the patient who are the intended user of medical or healthcare technology must basically ensure that his/her right to live and freedom of choice is not compromised. In the present study an attempt has been made to understand how policies have evolved globally and nationally to ensure health and human security.

There are important corollaries based on observations of pluralistic authority sphere of state, global organizations and the industry of medical devices. The first question naturally is – ‘how do these myriad actors fit together in common purpose for governance of medical devices to address global health issues?’. Not only the profit driven industry of medical devices determine how and where the research money will be directed, to complicate the issues of technology penetration further one also needs to factor in the professional communities of technology practitioners- the physicians, paramedics, and healthcare technologists that will ultimately decide which technology is adopted. There are the national governments and trade agencies with conflicting interest of a nationalised health agenda at
one end and the motive of profit in the other. The myriad of actors and interests need to converge to a point wherein the benefit of technology will reach the patient or population, at a minimum cost of resource and safety.

Faced with the challenges of pluralistic authority spheres, at a next level one might further ask ‘Whether plurality of organizations provide a robust governance structure to coordinate, govern, and monitor the health issues in a global or national context?’. To build a strong framework of policies, practices and institutions drawing from all the stakeholders is a daunting task. Not only the national regulations concerning safe use of technology needs to be built within confines of global practices, but a system of surveillance for limiting adverse effects of medical devices need to be built at the local and regional levels. Building a system in each healthcare facility to induct & train people on safe practices concerning medical device, monitor user behaviour and putting in place an error report or adverse event reporting system is really a herculean task for most of the developing world healthcare system- on grounds of resource, manpower and availability of knowledge transfer options.

Finally the question on state’s control over the issue of medical device governance needs to be examined – ‘What is the role of the state in governance of medical devices?’. Building a safer environment of medical devices use can be attempted by state legislatures with an eye on enforcements. The challenge seems to be involving the professional bodies of physicians, technologists and paramedics to formulate the uniform guidelines. There is very little perceptible activity by most of the professional bodies in developing world. The present research is concerning itself on finding out what is the dominant trend in medical device regulation, in public as well as private sectors. Accordingly, the present study is trying to understand the perception of public on such issues of medical device or healthcare technology in general from the available media publications. The perception of healthcare practitioners regarding technology regulation and medical device governance is looked into an empirical research which is detailed in the subsequent chapters. The question of state’s role is researched by us based on the publically available documents of concerned departments of government of India, and the state government of Assam, followed by a review of declared health policies. The entire focus of the present work is finally directed towards policies and practices concerning safe use of medical devices at the microlevel- in the city of Guwahati, Assam. Chapter 6 is entirely devoted to this micro study.
Following sections capture the emerging global frameworks and debates on governance of healthcare technology.

4.4: Definition, Risk Stratification and Classification of Medical Devices

In conformity with the objectives of the study, the following sections will narrow down the governance of healthcare technology to governance of medical devices. For a practical understanding of what constitutes a medical device the present study accepts the simplified but elaborate definition enlisted by the Global Harmonization Task Force (GHTF), which is adopted in the World Health Organisation (WHO) literature\textsuperscript{11}.

\textit{GHTF definition of medical device:}

“Medical device” means any instrument, apparatus, implement, machine, appliance, implant, in \textit{vitro} reagent or calibrator, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination, for human beings for one or more of the specific purposes of: diagnosis, prevention, monitoring, treatment or alleviation of disease; diagnosis, monitoring, treatment, alleviation of or compensation for an injury; investigation, replacement, modification, or support of the anatomy or of a physiological process; supporting or sustaining life; control of conception; disinfection of medical devices; providing information for medical purposes by means of \textit{in vitro} examination of specimens derived from the human body and which does not achieve its primary intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means.

Thus from the above definition it can be understood that medical devices are everything from band aids to x-ray machines, contact lenses, hip implants, pacemakers, crutches, hospital beds and in \textit{vitro} diagnostic devices.

Considering the variety of items, medical devices are usually divided into subgroups. In European Union (EU) medical devices are divided into three different groups; Active Implantable Medical Devices (AIMD), General Medical Devices and In Vitro Diagnostic Devices (IVD). An active medical device is a device that requires a source of energy to function. An invasive medical device is a product that in some way enters the human body.
The device is then called invasive, surgically invasive or implantable depending on how the device is entering the body and the time it is introduced to the body. An in vitro diagnostic device is a reagent, reagent product, instrument or system used to examine samples from human tissues or fluids to gain information. In vitro diagnostic devices are also divided into subgroups. These general groupings are recognized and used by most other countries as well. The main difference between countries is how these devices are regulated. In some countries medical devices are regulated as drugs and in other countries there are special regulations for medical devices.

What is now attempted is to understand in a simplified way the risk based classification system of these medical devices, for the purpose of relating challenges of governance of medical devices. Risk based classification of medical devices is necessary to apply correct regulations and quality control systems. It is not feasible economically nor justifiable in practice to subject all medical devices irrespective of their nature by most rigorous conformity assessment procedures. A graduated system of control is more appropriate. In such a system, the level of control corresponds to the level of potential hazard inherent in the type of device concerned. A medical device classification system is therefore needed, in order to channelise medical devices regulatory control. Medical devices are divided into different categories. The classification identifies the level of regulatory control that is necessary to assure the safety and effectiveness of a medical device.

In the United States medical devices are classified as class I (General Controls), II (Special Controls) or III (Pre-market Approval) devices where class III devices represent the highest risk and require more control. The basic concept of medical device classification as carried out in the USA is presented here in a tabular form in table 4.1

Table 4.1 Classification of Medical Devices in the U.S.A.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Risk Level</th>
<th>Regulatory control</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Low</td>
<td>General control is sufficient, these are over the counter products</td>
<td>Adhesive bandages, hospital beds, wheelchair</td>
</tr>
<tr>
<td>Class</td>
<td>Performance standard and general control, Physician controlled distribution</td>
<td>Oxygen masks, blood pressure cuffs, surgical sutures</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Class II</td>
<td>Moderate</td>
<td>Class III moderate to high</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Require structured type of control for their safety and efficacy purpose</td>
<td>Pacemaker, Vascular grafts</td>
<td></td>
</tr>
</tbody>
</table>

Source: U.S. Food and Drug Administration, Overview of Device Regulations, 2007)\(^\text{13}\)

In the European Union general medical devices are classified as class I sterile & class I measuring, class IIa, class IIb or class III where class III devices represent the highest risk (Table 4.2). Active implantable medical devices are not classified and in vitro diagnostic devices have their own classification system.

**Table 4.2 European Medical Devices Classification**

<table>
<thead>
<tr>
<th>EU class</th>
<th>Device type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Low risk to the patient and, except for sterile products or measuring devices, such devices generally do not enter into contact or interact with the body</td>
<td>Stethoscopes, EEG and ECG electrodes, body liquid collection devices, wheel chair</td>
</tr>
<tr>
<td>Class IIA</td>
<td>Medium risk, and are invasive in their interaction with the human body, but that interact with the body only through natural body orifices. Also include therapeutic non-medicated gauze devices used in diagnosis or in wound dressings, urinary catheters management</td>
<td>Syringes and tubing intended for use with infusion pumps, blood transfusion devices, body orifices.</td>
</tr>
<tr>
<td>Class IIB</td>
<td>Medium risk, and are either partially or totally implantable within the human body, and may modify the biological or chemical composition of body fluids</td>
<td>Dialysis apparatus, medicated gauze, dressing</td>
</tr>
</tbody>
</table>
Class III High risk, and generally affect the functioning of vital organs and/or life support system. Cardiac pacemakers and defibrillators, drug-eluting stents, breast implants, knee impart

Source: Medical device regulation, Global overview and guiding principles, Copyright WHO 2006, Geneva

The rules that classify devices in Europe combine the following criteria:

- Duration that the device is in contact with patient
- Whether it is invasive or non-invasive
- Degree of invasiveness
- Anatomy affected by the device
- Active and non-active (based on source of power)
- Special situations (e.g. devices incorporating a medicinal substance, contact lens solution).

In Japan medical devices according to Pharmaceutical affair Law (PAL) are classified into four categories. A new system of classification separates the medical devices into three classes, which is based on the device classification of the global harmonization task force and basically depend on risk based system. Table 4.3 presents the medical device classification in Japan.

**Table 4.3 New Classification System of Medical Devices in Japan**

<table>
<thead>
<tr>
<th>PAL classification (Previous classification)</th>
<th>New classification</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>General medical devices</td>
<td>Extremely low</td>
</tr>
<tr>
<td>Class II</td>
<td>Controlled medical devices</td>
<td>Low</td>
</tr>
</tbody>
</table>
The regulation regarding confirmation of safety and efficacy of medical devices differ from country to country. There is difference in classification and gradation of equipment or device safety from country to country. The point is made clear in table 4.4 which is showing the regulatory approach of devices in three different contexts: in the United States of America, European Union and Japan. Manufacturers of medical devices need to adjust to the regulatory framework in the country where the product is sold. This constitutes a great problem for manufacturers, especially for companies selling their products in several countries. Competent authorities worldwide have begun to realize the problem and collaborate to harmonize the regulations. The Global Harmonization Task Force (GHTF) included of representatives from regulatory authorities in USA, European Union, Japan, Australia and Canada that work to harmonize the regulations for medical devices and improve the safety, effectiveness and quality of the devices. The group had developed guidelines for pre-market evaluation, post-market surveillance, quality systems, auditing and clinical safety/performance. Many countries have begun to adopt these guidelines or follow the United States Food and Drug Administration (FDA) regulations or the European Medicines Agency (EMEA) regulations. There is a need to establish a uniform format for different countries to certify that the medical device being exported complies with their domestic regulatory requirements.

**Table 4.4 Comparative Regulatory Aspects**

<table>
<thead>
<tr>
<th>International classification</th>
<th>EU system</th>
<th>U.S system</th>
<th>Japanese system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>No approval necessary</td>
<td>No approval necessary</td>
<td>No approval necessary</td>
</tr>
<tr>
<td>(extremely low risk)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class II (low risk)</td>
<td>3rd party certification (site inspection only)</td>
<td>Government approval necessary (limited 3rd party initial review)</td>
<td>3rd party certification (site inspection only)</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Class III (Medium risk)</td>
<td>3rd party certification (site inspection only)</td>
<td>Government approval necessary (limited 3rd party initial review)</td>
<td>Government approval necessary (limited 3rd party initial review)</td>
</tr>
<tr>
<td>Class IV (High risk)</td>
<td>3rd party certification (document examination necessary)</td>
<td>Government approval necessary (limited 3rd party initial review)</td>
<td>3rd party certification (site inspection only)</td>
</tr>
</tbody>
</table>

Source: Comparative table is based on source 11, 13 & 16

The International Medical Device Regulators Forum (IMDRF) has replaced the GHTF in 2011 as a forum to further assist the cause of medical device regulatory harmonization. It is a voluntary group of medical device regulators from around the world who have come together to build on the strong foundational work of the Global Harmonization Task Force on Medical Devices (GHTF), and to accelerate international medical device regulatory harmonization and convergence. Currently all documents and functions related to GHTF is archived within this new organisation of device regulators. The device classification system developed by the GHTF, is being adopted by regulators of various countries. A number of factors, including for example the duration of device contact with the body, the degree of invasiveness, whether the device delivers medicinal products or energy to the patient, whether they are intended to have a biological affect on the patient and local versus systemic effects (e.g. conventional versus absorbable sutures) may, alone or in combination, affect device classification. It is recommended that based on the manufacturer’s intended purpose, two or more classification rules apply to the device, the device is allocated the highest level of classification indicated. Where one medical device is intended to be used together with another medical device, that may or may not be from the same manufacturer, (e.g. a physiological monitor and a separate recorder, or a general purpose syringe and a syringe driver), the classification rules should apply separately to each of the devices. Table 4.5 describes the GHTF medical devices classification.
Table 4.5 GHTF General Classification System for Medical Devices

<table>
<thead>
<tr>
<th>CLASS</th>
<th>RISK LEVEL</th>
<th>DEVICE EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Low Risk</td>
<td>Surgical retractors / tongue depressors</td>
</tr>
<tr>
<td>B</td>
<td>Low-moderate Risk</td>
<td>Hypodermic Needles / suction equipment</td>
</tr>
<tr>
<td>C</td>
<td>Moderate-high Risk</td>
<td>Lung ventilator / bone fixation plate</td>
</tr>
<tr>
<td>D</td>
<td>High Risk</td>
<td>Heart valves / implantable defibrillator</td>
</tr>
</tbody>
</table>

Source: Principles of Medical Devices Classification, 2006

4.5: Relevance of Safety Concepts in Medical Device for Regulatory Controls

Safety of medical devices can only be stated in relative terms. All devices carry a certain degree of risk and could cause problems under certain specific circumstances. Many medical device problems cannot be detected until extensive market experience is gained. For example, an implantable Joint prosthesis or a pacemaker may fail in a manner that was not predictable at the time of implantation and the device failure may reflect conditions unique to certain patients. The current approach to medical device safety is to estimate the potential of a device becoming a hazard, and this estimate is often referred to as the risk assessment. We can understand hazard as a potential for an adverse event or a source of danger. Risk in turn is a measure of the combination of the hazard and the likelihood of its occurrence, and severity of the event in terms of impact on health status of the individual. Thus risk assessment begins with risk analysis to identify all possible hazards from a medical device. Risk assessment can be done identifying the hazards followed by an understanding to its likelihood of occurrence from experience, evidence, computation, or even guesswork. Risk assessment is a complex system which is in turn influenced by personal perception and other factors such
as cultural, social, educational background, economic conditions, and regulatory climates. For example, a car with reasonable safety features might be seen as an item of low to moderate risk in a city where most people have experience with cars, own or drive a car and the city has a reasonable traffic system and control of eligibility requirements for driving a car in the form of a licence. The same car may be seen as an extremely hazardous item if a person without experience operates it in a remote corner of the world with no proper road or traffic regulation, whose population is not fully familiar with the functioning of such an item. Same parameters are more or less true for medical device.

An invasive medical device like a pacemaker is usually considered to have higher potential hazard than an equivalent non-invasive device (e.g. there are invasive and non-invasive blood pressure monitors with different perception of risks). Similarly, devices that have a long duration of contact with bodily organ such the brain or heart or the great arteries, are assigned higher levels of potential hazard. The degree of regulation that needs to be brought in should be in proportion to its potential hazard. This approach is known as risk management. The first requirement of the “Essential principles of safety and performance of medical devices” formulated by the GHTF (SG1-N020R5) and now adopted at IMDRF illustrates such an approach. It states that:

“Medical devices should be designed and manufactured in such a way that, when used under the conditions and for the purposes intended and, where applicable, by virtue of the technical knowledge, experience, education or training of intended users, they will not compromise the clinical condition or the safety of patients, or the safety and health of users or, where applicable, other persons, provided that any risks which may be associated with their use constitute acceptable risks when weighed against the benefits to the patient and are compatible with a high level of protection of health and safety.”

This statement conveys the global thinking on risk vs. benefit nature of medical devices. The general objective of all regulatory effort is to maximize benefit and minimize risk. Globally medical device manufacturers tend to use the risk management approach. The International Organization for Standardization (ISO) has produced a document (ISO 14971:2000) providing manufacturers with a framework including risk analysis, risk evaluation and risk control for risk management in medical device design, development, manufacturing as well as for monitoring the safety and performance of the device after sale.
4.6: Governance Concepts Related to Effectiveness and Performance of Medical Devices

Effectiveness and performance of medical devices are two very important concepts which are interrelated\(^9\). Generally each medical device has a designed purpose. A medical device is considered *clinically effective* when it produces the effect intended by the manufacturer relative to the medical condition. For example, if a device is intended for regulating the heart beat and one expects the device to actually regulate the heart than it would be necessary for the manufacturer to possess objective, scientific evidence, such as clinical test results showing actual functioning of the device in a clinical setting. Clinical effectiveness is a good indicator of device performance. *Performance*, however, may include technical functions in addition to clinical effectiveness. For example, an alarm feature may not directly contribute to clinical effectiveness but would serve other useful purposes. Furthermore, it is easier to measure objectively and quantify performance than clinical effectiveness. Performance is closely linked to safety. For example, a blood collection syringe with a blunt needle would perform badly for collecting blood and could inflict injury. A cardiac or blood sugar monitor that does not perform well could pose serious clinical safety problems to the patient. Thus, the safety and performance of medical devices are normally considered together. The attempted regulatory mechanism must ensure that a device is in fact clinically effective or beneficial as claimed by the manufacturer and also incorporates basic safety and design features to keep its performance within desirable limits. The role of the regulatory authority is to ensure that the manufacturer has effectively implemented the risk management process.

4.7: Graduated Regulatory Control Based on Risk Stratified Device Classification

The whole idea of medical device classification was focused towards effective control and regulation of equipment that may have health hazard with inappropriate use. It is generally agreed upon fact that level of regulatory control should increase with increasing degree of risk\(^20\). The concept is graphically represented in Fig 4.1. It must also be considered that imposition of regulatory controls should not place an unnecessary burden on regulators or manufacturers. Some of the examples of regulatory controls on manufacturing of medical devices may include:

- Enforcing a quality control system for manufacturing and keeping in place independent external audit of the manufacturer’s quality system.
- Presenting technical data and literature with device (in certain class of devices or equipment) and provision of independent external review of the manufacturer’s technical data.
- Clinical trials before marketing and documentation of evidence to support the manufacturer’s claims.

Apart from the manufacturer the service provider for example the Physician, Hospital and healthcare facility can also be brought under regulatory control. Development of practice guidelines by professional bodies of physicians, technologist, and paramedical workers for safe use of medical device is of paramount interest. Safety protocols, training on use of devices, equipment or device maintenance and their disposal on non-use can be included under regulatory mechanisms.

![Fig 4.1: Illustration of Regulatory Controls Increasing with Device Risk Class](image)

4.8: Understanding Medical Device Life Cycle and Scope of Governance

There are few general stages of most medical devices from conception to manufacturing it, from use to disposal. The lifecycle of medical device is a necessary understanding for any researcher on issues of governance. The following paragraphs will briefly outline the life cycle of a device and also the scope of governance in each stage of a product.
**Governing development of medical device**

Medical devices are products of scientific principles or developments in basic sciences. While developing a device the developer needs to understand the scientific principles upon which a device function depends. For example, a cardiac pacemaker should deliver a minute electrical impulse of a certain intensity and shape that simulates the natural functioning of the heart, based on current understanding in electrophysiology of the heart impulse. A large deviation from this natural physiology may compromise safety and performance. The more complex the device is, the higher is the risk of user error. In governing technology and device design regulatory mechanism will have to keep in place a review mechanism by scientific field experts to ensure soundness of concept and adequacy of design, construction, and testing (including verification, validation and clinical trials) so that the design parameters and performance characteristics do not impose unwarranted risks to the health of patients.

**Governing device manufacture & packaging**

During the phases of manufacture regulatory mechanisms need to ensure that medical devices are produced under strict quality control checks to avoid passage of sub-standard or non-conforming devices to market. It has been seen even when the original prototype has been well-designed, subsequent failures at production can degrade product efficacy and safety standards. This consideration has led to the development of good manufacturing practice (GMP) for drugs, biological products and medical devices.

Properly packaged medical devices with accompanying instruction booklets for use and disposal reduce risk of adverse events. Packaging and labelling guidelines, maintenance of delivery standards with reference to sterility are essential spheres where regulatory controls are not only welcome but a must. Most medical devices are produced in the developed world from where they are shipped across long distances to the users. Shipping is one of the hazards a medical device and its packaging must survive. Subtle damage can result during transportation and handling unless the total packaging system is designed robustly and can withstand various stresses. Well-sealed packaging is essential for those medical devices that must be maintained sterile. As in case of drugs, mis-labelling of medical devices can result in serious consequences for the user. Hazard warnings or cautions and clear instructions for use are very important.
Governance of marketing medical devices

Advertisement and marketing efforts by profit seeking manufactures has the potential to produce collusive behaviour among the service providers. Apart from putting clear guidelines on pricing of product, regulatory controls on advertising is important. It is definitely very important that medical device marketing and advertising are regulated to prevent misrepresentation of a medical device and its performance. Misleading or fraudulent advertising of medical devices may increase sales and thus effect bottom lines of the sellers and manufacturers. The sale of medical devices by the vendor is a critical stage that leads to the device being actually put into use. If the vendor is not subject to regulation, then there is higher risk of exposing the public to low quality or ineffective devices.

Governance of advertising and marketing of medical devices

Governing users of medical device

Conduct of the device users or service providers like physician, technologist, healthcare establishment effects medical device performance and safety standards. Unfamiliarity with a certain technology or operating procedure, and the use of products for clinical indications outside the scope of those specified in the labelling, can cause device failure even in the absence of any inherent design or manufacturing defects. We have already detailed accounts of iatrogenesis from faulty uses in Chapter 3. The reuse of disposable devices contrary to the manufacturer’s instructions, and without proper control or precautions for minimizing associated risks can be dangerous. The lack of or inappropriate calibration and maintenance of medical devices can seriously jeopardize their safety and performance. These issues are often overlooked or underestimated. Safe practice guidelines, local regulatory practices and institutional mechanism need to be in place wherever medical devices are used. Our empirical work is detailing this aspect of governance in Chapter 5.

Governing disposal of medical devices

Inappropriate disposal of devices that are contaminated after use (e.g. syringes) or devices that contain toxic chemicals can present hazards to people or the environment and must be disposed of properly. Radioactive wastes, electromedical device wastes too are challenges to public health. Scope of putting effective regulation in these spheres of medical device safety is still being explored.
Finally, it must be understood that there are different stakeholders that manage each phase in the life span of a medical device, and these stakeholders need to be identified and called on to participate in ensuring medical device safety. As discussed in the preceding paragraphs, the device manufacturer usually manages the first three phases of the medical device’s life span. The Vendors that includes importers, distributors, retailers and manufacturers who sell medical equipment control the next phase. The final phase of life cycle is controlled by the user is usually a professional in a health care facility, but may also be the patients.

In addition to these three categories of people who are the visible stakeholders in medical device governance debate the other parties are public/patient and the government. The public/patient are the ultimate beneficiary of medical devices, and in the case of over the counter (home-use) devices, they are the end-user as well. The government has the responsibility of overseeing that medical devices sold in the country are safe and effective.

4.9: Identification of Responsibilities of Stakeholders in Medical Device Governance

The previous sections have comprehensively focussed on most of the aspects of the medical device governance, the risk assessment concept and graduated regulation levels as well as the concept of device life cycles. The preceding paragraphs also tried to identify the key stakeholders that need to interact in effectively formulating a governance framework of medical devices. This section will endeavour to enumerate the facets of policy design and governance issues for each of the stakeholders. It has been already spelled out that the Manufacturer, Vendor, User, Public and Government are the most important stakeholders. All five play critical roles in ensuring safe use of medical devices. The most important denominator that ensures cooperation of all these stakeholders is informed and common understandings of the issues involved. The desired common understanding can be achieved by having all stakeholders participate in establishing the process that ensures safety and performance of medical devices.

While formulating a policy for the manufacturer, as the creator of the device this must be ensured that all devices go through stringent quality checks and conform to the prescribed standards of safety and performance. Policy formulation must consider all the phases of design and development, clinical and laboratory testing, manufacturing, packaging and labelling that enables the market ready medical device. The plants or industrial hubs that
manufacture equipments and devices must have proper licensing and regulatory processes to ensure liability and responsibility for the products they manufacture. Clinical trials need to be controlled and should be overseen by concerned regulatory bodies to ensure reproducibility of results. Multicentre trials of devices need to be monitored for uniformity of data. Overall transparency in granting legitimacy to manufacturer’s claims on efficacy must be present in governance framework.

The vendor rules the market as an intermediary between the manufactured medical device and the user. Policy for the Vendors should ensure that the products sold comply with regulatory requirements. With increasing public interest in health and a competitive marketplace, vendors should be careful to avoid making misleading or fraudulent claims about their products or issuing false compliance certificates. Ethical advertising must be the norm and appropriate regulatory framework needs to be in place for ensuring compliance. In addition, regulatory framework for used or refurbished devices should be in place. It must be ensured that Vendors with help from manufacturer should provide after-sale service. Safe operation of many sophisticated medical devices often require specialized user training from the manufacturer for proper use and service. It is important to have a regulatory bindings on the vendor to confer such trainings as condition of sell. Phase IV trials of many of the medical devices in use require co-operation of the seller, for tracing out such devices in use. Participating in post-market surveillance (receiving and reporting customer complaints/incidents) is critical for ensuring medical device safety and performance, and it should be a part of medical device regulation policies. For example, the vendor must make arrangements for processing complaint/incident reports relating to medical device safety and performance. In the case of home-use medical devices, the vendor should recognize that the device being sold might end up in the hands of a layperson who may need special instructions for the proper use and maintenance of the device. In this situation, efforts must be made to provide non-technical instructions and to educate and help the customer.

The user of any medical device may be a physician, nurse, technologist or paramedical worker or in case of home use device, such as thermometer - even a lay person. For most devices used in the institutional setting the user is identified as a professionally qualified or trained individual. Such institutional or professionally qualified users of medical device must ensure that he/she has qualifications and training in the proper use of the device, and is familiar with the indications, contra-indications and standard operating procedures as
recommended by the manufacturer. It is crucial that experience gained with medical devices be shared with other users, the vendor & manufacturer to prevent future problems. This can be done by reporting any incidents to a coordinating centre from which warnings can be issued. While using medical devices user has the responsibility to employ the medical device only for the intended indications (or to assure that any non-indicated use of the medical device does not compromise the safety of the patient and other users). Governance mechanism within the institution should specify responsibility to ensure proper maintenance of medical devices during active use and safe disposal of obsolete or out of order medical devices.

The government has the overall responsibility to ensure health of public, and promote equality of access to healthcare. Government must ensure that the manufacturing industry conforms to the set safety standards for medical devices, and any devices sold or imported must meet all safety norms. Policies governing the industry and market must reflect the concerns expressed in the preceding paragraphs for each stakeholders. It is the government that has the institutional infrastructure to formulate law and bills and oversee their implementation in a correct manner. Governmental regulation and taxation needs to promote a safety culture for medical device. To promote access for safer medical devices, various economic instruments are at disposal with the policy maker. Health technology assessment process can identify favoured technology in a resource poor setting. Government has the daunting task of balancing resource with need, safety and quality versus availability. Life saving devices like pacemaker, dialysis machines, Imaging equipment or laboratory equipments must be made available in reasonable abundance in the healthcare delivery systems. Government has a steward-ship role to play in creating healthy cooperation among stakeholders in establishing policies and regulations that are fair to all.

Public or the patients are the ultimate beneficiary of medical devices. They should be made fully aware that all devices carry a certain risk and that they can help to promote safety and performance through self education. Medical devices are increasingly available for home use, making the Public the direct user. Purchasers of home-use medical devices should be aware of associated risks and take the responsibility to become educated in the functions and correct operating procedures for those devices.
In conclusion, the ideal conditions that will ensure the safety and performance of medical devices require shared responsibility by all stakeholders.

4.10: A General Overview of Country Specific Regulation of Medical Devices

So far the basic concepts of medical device governance with a focus on safety are discussed. A proper understanding of the issues related to medical device safety will now be utilized in this section to critically acclaim how these concepts are reflected in medical device policies of certain developed countries. In selecting the countries we have decided to include the top three device market & manufacturer of the world: they are the European Union, Japan and the United States of America. The following table 4.6 depicts the common characteristics of these top three countries, based on published research report.

Table 4.6 Medical Device Related Data on Production, Consumption, R&D in EU, Japan, USA as of 2005.

<table>
<thead>
<tr>
<th>Medical device</th>
<th>EU</th>
<th>Japan</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global share</td>
<td>30%</td>
<td>10%</td>
<td>51%</td>
</tr>
<tr>
<td>Value of production</td>
<td>38 billion $</td>
<td>14.2 billion $</td>
<td>92 billion $</td>
</tr>
<tr>
<td>Population (2005)</td>
<td>457.0 million</td>
<td>298.4 million</td>
<td>127.5 million</td>
</tr>
<tr>
<td>Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global share</td>
<td>30%</td>
<td>10%</td>
<td>50%</td>
</tr>
<tr>
<td>Value (2005)</td>
<td>38.1 billion $</td>
<td>19 billion $</td>
<td>90.2 billion $</td>
</tr>
<tr>
<td>GDP % of National healthcare expenditure (2005)</td>
<td>7-8%</td>
<td>8%</td>
<td>15%</td>
</tr>
<tr>
<td>R &amp; D expenditure as % of sales</td>
<td>6%</td>
<td>6%</td>
<td>10-13%</td>
</tr>
</tbody>
</table>

Source: Based on USITC, 2007

The political entities in our study comprises of two advanced industrial countries (USA & Japan), and the European Union is seen as a regional block, consisting of 27 members. These are democratic nations and they all are leaders of the G7 and their industries are among the most productive and innovative in the world. They also spearheaded globalised regulatory
effort by forming the Global Harmonization Task Force (GHTF), in 1993, and are supporters of medical device safety, effectiveness and quality, international trade, and technological innovation.

It has been noticed that the healthcare systems of the US, EU & Japan provide for care of the highest quality, although each of them differs in structural foundations, orientations, and goals. From the table 4.6, it is evident that the health expenditure represents about 15% in the U.S. and 7-8% of GDP in both the EU member states and Japan. The healthcare systems use public and private financing and avail themselves of public, private and for profit organizations for delivering health services. All these healthcare systems have a tangible system of insurance coverage and compensation schemes, which are at the heart of recent health care reform.

In addition, these systems, by dint of their leadership role in medical device production dictates terms that determine access to medical technologies, which is a further motivation to study their regulatory models for our purpose. Based on presence of advanced research & manufacturing facilities, these three chosen entities top the global list. The United States of America outpaces the foreign competitors in terms of sales, trade volume, innovations, competitiveness (understood as R&D, patents, and publications).22

Seventeen top global U.S. companies (out of a total of 20 global traders) supply most of the sophisticated advanced medical technologies in the world. There are only three EU companies-. Siemens Medical Solutions, Philips Medical Systems and Becton Dickinson & Co, that makes into top twenty. Japanese company in this league is Terumo, which ranks 25th on the world list. Thus the heavy concentration of research, innovation and manufacturing units in these political entities make it a justifiable study subject for any research into medical device regulation.23

Case selection of the present study is further justified by the available data on the world market and the industry. When data are broken down by markets, the U.S. is the largest market (50%), followed by the European Union (30%), Japan (10%), and others (10%). If the data are broken down by traders, the EU is leading (30%) followed by the U.S. (29%), Japan (9%), China (4%) and Switzerland (4%).24
With all these understanding on justifying case selection, the subsequent sections of the chapter will briefly review the existing regulatory processes in the EU and Japan followed by USA. We shall than proceed to summarise our understanding in a comparative table, keeping few attributes of the regulatory process.

4.10.1: The European Union

The European Union (EU) is a political and economic community in the European continent. The EU represents the largest world economic community and generated in 2011 an estimated GDP of 12,449,000 millions Euro\(^2\). The Treaty of Rome signed in 1957 between six European countries is generally considered as the birth certificate of what is now the European Union\(^2\). In 1993, the Treaty of Maastricht established the current legal framework that was further developed by the Treaty of Nice (2001) and amended by the Treaty of Lisbon signed in 2007 and intended to come into force in 2009. The EU creates a single market by a system of laws which apply in all Member States guaranteeing the freedom of movement of people, goods, services and capital. In 1999 the EU introduced a common currency, the EURO, which since has been adopted by a total of eighteen member states (since 1\(^{st}\) of January 2008).

The medical device industry of the European Union reached estimated global sales of about €95 billion, as per European Commissions press report in November 13\(^{th}\), 2012\(^2\). This represents about one third of the global market for medical devices\(^2\). Following the United States, Europe represents the second largest medical device manufacturing entity of the world.

In 1985, Europe adopted a ‘New Approach to Technical Harmonization and Standards’ to promote the free movement of goods among member states within the European Union. This replaced the existing product regulatory and safety requirements of individual member states with “essential requirements” covering all of Europe: European Community Directives (called New Approach Directives). The overview of the Directives was updated in the so-called ‘New Approach and Global Approach’\(^1\).

The New Approach Medical Device Directives were based on the following principles\(^2\):
Definition and harmonization of Essential Requirements addressing the mandatory requirements for medical devices such as health, safety, efficacy, consumer protection and environmental protection. The Essential Requirements are laid down in three main directives (90/385/EEC-Active Implantable Devices, 93/42/EEC-Medical Devices, and 98/79/EC-In Vitro Diagnostic Devices).

Only medical devices fulfilling the Essential Requirements may be placed on the Community market.

Applicable Harmonized Standards (EN standards or ISO standards), published in the European Official Journal (OJ) with the respective reference numbers and transposed into national standards are presumed to conform to the corresponding Essential Requirements Fulfilment Assumption.

Obligation of the manufacturer to subject the product to a Conformity Assessment.

Obligation of the manufacturer to implement and operate a full Quality Management System (QMSystem) according to EN ISO 13485:2003 or modules thereof.

Third Party inspections of the QM-System, as well as Third Party Conformity Assessments of certain high risk class medical devices. Those are carried out by Notified Bodies designated by the Member States among bodies that fulfil the requirements laid down in the main directives and that are established in their territory.

Implementation of an integrated Market Surveillance and Information System as essential tool for enforcement of the medical device directives with the purpose to ensure that the provisions of the medical device directives are met across the European Community.

The principles enlisted above tend to achieve a safe culture of medical device use. The laid down principles clearly fix up responsibilities of the industry, and provides for inspection by competent inspectors. Any medical device in use or in market for long time can be in principle subjected to surveillance check for continued safety standard.

No medical device without full compliance to the enlisted principles is allowed in the market under these directives. Medical devices placed on the European Community market must comply with the provisions of the New Approach MD Directives and must also bear the CE-Mark.
The risk assessment process accounts for the fact that Devices can only be placed on the market provided that any risks that may be associated with the use of the device constitute acceptable risks when compared to the benefits to the patient and are in compliance with a high level of protection of health and safety. In order to assure these basic demands, the manufacturer has the obligation to subject the medical device to a detailed Risk Assessment along with Risk-Benefit Analysis. Risk Management Process comprising the entire life span of the product must be established. The manufacturer has the obligation to document and make available all measures, including the underlying technical documentation, in a so called Technical File or Design Dossier. The onus of providing safety data squarely rests on medical device manufacturer.

**Legal demarcation of device and drugs**

The determination of the borderline between medical devices and medicinal products (drugs or pharmaceuticals) was an extremely important issue discussed during the legislative procedure on the Medical Device Directives. Consequently the medical device directives do provide in Article 1a definition of medical devices and some related terms:

‘Medical device means any instrument, apparatus, appliance, software, material or other article, whether used alone or in combination, together with any accessories, including the software intended by its manufacturer to be used specifically for diagnostic and/or therapeutic purposes and necessary for its proper application, intended by the manufacturer to be used for human beings for the purpose of:

- diagnosis, prevention, monitoring, treatment or alleviation of disease,
- diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap,
- investigation, replacement or modification of the anatomy or of a physiological process,
- control of conception,

and which does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means……’

In EU definition the demarcation between medical devices and medicinal products is based in the Principal (Main) Intended Mode of Action of the product. Typically the medical device
function is characterized by physical means (including mechanical action, physical barrier functions, replacement of or support to organs). The action of a medicinal product is generally achieved by pharmacological, immunological and metabolic means.

The following practical example of eye drops may also contribute to the better understanding of the principles of demarcation:

Eye drops, that typically consist of a 0.1% solution of hyaluronic acid in water, are intended to prevent the cornea from drying. The intended mode of action is a physical one (to keep the eye wet). Consequently such products are classified as medical devices.

It is also interesting to note, that the European definition of medical devices and the principles of demarcation have gained a wide acceptance within the global harmonization approach. The erstwhile Global Harmonization Task Force (GHTF) had proposed a definition for medical devices that is nearly identical to the provisions in Article 1 of the European directives.

Product Risk Classification

Medical devices are classified according to their intended purpose (and not to their particular technical characteristics). Annex IX of the Medical Device Directive contains 18 rules for classifying devices. These rules must be used to guide the manufacturer to determine whether the device is Class I (low risk), Classes IIa, IIb (medium risk) or class III (high risk). The choice of the correct risk classification is based on various criteria related to potential risks associated with the use of the device. These principles for device class stratification can be summarized as follows:

- Duration that the device is in contact with skin, tissues or body fluids (transient: < 60 min, short term: ≤ 30 days, long term: > 30 days).
- Invasive or non-invasive.
- Degree of invasiveness (i.e. implantable medical device).
- Reusable (surgical) instruments.
- Active or non-active devices (Based on power source).
• Therapeutic or diagnostic intended purpose.
• Critical body compartments affecting mode of action (e.g. central circulatory system or central nervous system).
• Special devices (e.g. devices incorporating a medicinal substance, stable derivatives derived from human blood or devices utilizing animal tissue, contraception devices, disinfection and cleaning devices, blood bags etc.).

As a general rule, these criteria consider the risk of a device which is composed of the duration of use or contact time with body compartments, fluids or tissues, the level of invasiveness and the potential risks associated with the intended use.

4.10.2: Japan
Though Japan is geographically Asian, the standard of healthcare and the medical device market is unparalleled in Asia and the developing world. Even though the geographical expanse of the country is no match to European Union or the USA, Japan comes very close to these economies in terms of healthcare expenditure and size of medical device industry. The elderly population in Japan is increasing and with that the demand of better and safer healthcare is rising.

Japan spends 3035 $ per capita on healthcare, and about 9.5% GDP on national healthcare as of 2009. For every 1000000 population there are 43.1 MRI units and 97.3 CT units. The demand of cost effective medical devices in Japan is huge. The most wanted medical devices have been stents, artificial joints and implants, CT, MRI and other image reading software. The Japanese medical device market is the second largest single country market in the world. Estimates on the exact market size range from US$18-US$23 billion, with U.S. exports to Japan accounting for about two-thirds of Japan’s medical device import market and about 25-30% of the total medical device market.

Japan has a long history of medical device regulations since 1960, when the Pharmaceutical Affairs Law (PAL) was amended to include medical devices and cosmetics. Prior to 2000 the regulation was not very stringent and even market approval for broad categories of devices could be obtained based on effective clinical data on only few of the members from the
group. It was not uncommon to obtain approvals on certain device models long before they were designed.

Following tainted domestic politics, regulatory models were revised to be more inclusive since 2005. A major impact was the “tainted blood scandal” in the late 1980’s, where government regulators delayed the introduction of heat-treated blood products, resulting in the infection of over 1800 hemophiliacs with HIV. There were further pressures on harmonizing the legal framework with outer world. The Medical device industry of Japan has to compete with the large players at EU & USA, and harmonising the home regulation was of paramount importance to them.

Major regulatory reform on Medical Devices began in Japan in 1985, with the Market Oriented, Sector Selective (MOSS) talks. One of the first topics addressed under MOSS was the ability to use non-Japan clinical data to obtain device approvals in Japan, something that was not allowed prior to the late 1980’s. Other major changes that have occurred are:

a) In 1995, in an effort to speed submission reviews, Japanese health ministry granted the Japan Association for the Advancement of Medical Equipment (JAAME) the authority to perform equivalency evaluation on “Me-Too” devices (those equivalent in design and indication to devices already on the Japanese market).

b) In 1997, to further expedite reviews, Ministry of health established the Pharmaceutical and Medical Device Evaluation Center (PMDEC) to perform evaluations, whenever necessary, after investigation by JAAME. In practice, PMDEC often re-evaluated “Me-Too” decisions made by JAAME, resulting in delayed (not expedited) reviews for most devices.

Till 2000, in Japan there were only two medical device categories- “Me-Too” and “New”. “Me-Too” devices normally required 4 months for review, while “New” devices normally required one-year for review. In 1999, approximately 3000 submissions were reviewed in Japan, with 90% judged to be “Me-Too” devices. In April 2000, several major changes & reforms were implemented in the review process. These include:

- The creation of a third device category, “Improved Medical Device”.

This is a category between “Me-Too” and “New”, intended to capture those devices that are new device designs for established indications or therapies.
Devices in this category include devices with materials/colorants for which there is no precedent approval in Japan, and devices with animal origin materials.

- Clear demarcation of authority sphere between reviewer agencies.

JAAME was allowed only to review those devices deemed to be substantially equivalent “Me-Too” devices, and PMDEC only reviews those devices deemed to be “Improved” or “New” medical devices. Ministry of Health issued guidance to manufacturers in 1999 (Notification 1677) to aid them in determining the classification of devices prior to submission.

In Japan, Ministry of Health, Labor and Welfare (MHLW) is responsible for food, medical care, labor policy and labor standards and social welfare. The Pharmaceutical and Food Bureau within the ministry is responsible for pharmaceutical and medical device regulatory policy making. A unit called the Pharmaceuticals and Medical Devices Agency (PMDA) is responsible for the registration of medical devices. In 2005 a new law came into effect which is harmonized with international requirements. The law is called the New Pharmaceutical Affairs Law (PAL). The main difference with international requirements is that Japan has special requirements for buildings and facilities of manufacturing sites. This can be understood that owing to the geographical vulnerability of volcanoes and accompanying Tsunamis & earthquake such provision became mandatory.

Under the Japanese process of Medical Device regulations, manufacturer must work according to Market Authorization Holder (MAH) system. This aspect of the regulation clearly demarcates responsibility of manufacturer and the intermediary. The process of marketing and surveillance is given full consideration in determining device safety. In this Japanese system the manufacturer is only responsible for production and the MAH is responsible for the release of the product to the market. This MAH can be a distributor, a third party or the manufacturing company itself if it has an office in Japan. Under the 2005 Pharmaceutical Affairs Law Revisions, MAH is responsible for all aspects of product quality, registration, and post-market surveillance. The MAH is responsible for obtaining registrations, ensuring the quality systems of the manufacturing facilities, developing release criteria in Japan for each imported product, retention of manufacturing, Quality Control, distribution records, and complaint records, and compliance with Japan vigilance requirements.
The Japanese classification system is described from Paragraph 4 to 8 of Article 2 of the PAL where paragraph 4 describes the definition of a medical device. The classification information is only available in Japanese. Present study cannot quote these owing to lack of proper translation from the document on publically available site. In summary, Medical devices are divided into General Medical Devices (Class I) described in paragraph 7, Controlled Medical Devices (Class II) described in paragraph 6 and Specially Controlled Medical Devices (Class III and IV) described in paragraph 5. IVD medical devices are classified as medical devices but no IVD medical devices are classified as class IV. IVD reagents belong to class II. Usually the MAH classifies the product. A medical device company is to use the Japanese General Nomenclature.

There is a focus on quality control in the governance of the medical devices by the Japanese government. There is provision of third party certification and inspection to ensure quality of devices. For manufacturers of medical devices certificates of Japanese Good Manufacturing Practice (GMP) and Good Vigilance Practice (GVP) are required to be in business. The quality certifications are done by third party certification bodies like Japanese Standards Association.

ISO 14971 has been adopted for an attempted risk management procedure in Japan but is not yet mandatory. ISO 13485 facilitates certification of Japanese GMP but Japanese GMP has special requirements for buildings and facilities of manufacturing sites that have been already mentioned.

Under the PAL, medical device manufacturer in Japan needs to obtain two licenses. One is the license given to a MAH and one is the license for manufacture. Foreign medical device manufacturers do not need a MAH license themselves, or a license for manufacture, but need to register their company with appropriate Japanese authority. These registration requirements are more or less same for foreign units like the home grown manufacture. The application for registration shall be completed by the foreign manufacturing facility but regulations allow for a MAH to apply on behalf of the foreign facility. All documents must be in Japanese although the attachments can be in English but with a Japanese translation.
Stratified classification based regulatory approval is adopted in Japanese system, like most other countries. A manufacturer must obtain a device notification, device certificate or device approval depending on the type of device. Medical devices class I require a device notification, medical devices class II require a device certificate and medical devices class III and IV require a device approval. Similarly, Clinical trials are not necessary for class I, in principle not necessary for class II, sometimes necessary for class III and in principle necessary for class IV.

Owing to language barrier in most Japanese offices, acceptance of foreign clinical data is low although it is officially accepted. In Japan it is mandatory to follow Good Vigilance Practice (GVP) & the MAH remains the safety controller who is responsible for reporting any incidents related to a medical device.

4.10.3: USA

United States has a track record of innovative regulatory controls of its industries. Considering the large number of industries in medical device sector, and their importance in public health safety the US government has brought in number of mechanisms to discipline this important industry.

The US Food and Drug Administration (FDA), under the authority of the Federal Food, Drug & Cosmetic (FFD&C) Act, commenced the modern era of regulation of medical devices with the Medical Device Amendments of 1976 (the amendments). This act has been modified significantly in more recent years by the Safe Medical Devices Act (SMDA) of 1990, followed shortly by the Medical Device Amendments of 1992 and also the Act of 1997 known as ‘FDAMA’ and Medical Device User Fee and Modernization Act (MDUFMA) of 2002. These various acts are instruments of the government for ensuring public health safety from devices\textsuperscript{34,35}.

A very interesting observation on FDA authority sphere is that the FDA regulation applies to manufacturers of finished devices intended for human use only, but not to manufacturers of components or parts of finished devices. This makes manufacturing unit fully liable for the quality or lack thereof in any of the component systems. This ensures vigilance and Quality control activity on part of the manufacturing unit of medical devices.
Quality system requirements are set out in the FDA’s Quality System Regulation, Part 820 of 21 CFR (Code of Federal Regulations). Medical devices regulation is controlled by the Centre for Devices and Radiological Health (CDRH).

Medical devices distributed in the United States are subject to General Controls, pre-marketing and post marketing regulatory controls.

Some of the important General Controls include:

- Establishment Registration by manufacturers, distributors, repackages and re-labellers,
- Medical Device Listing with FDA of devices to be marketed,
- Manufacturing the devices in accordance with Good Manufacturing Practices,
- Labelling medical devices in accordance with the labelling regulations, 21 CFR 801 or 21 CFR 809,
- Medical Device Reporting of adverse events as identified by the user, manufacturer and/or distributor of the medical device.

These general controls ensure that all manufacturing units are listed and traceable for their product. Even the distribution chain for the medical devices is accounted for within these controls. The problem of imported devices from far off countries, include language of instruction leaflets which are to be handled effectively by suitable package inserts in local language, thus keeping the packaging or reselling units under regulatory control serves the purpose of monitoring this aspect.

Like most countries device listing with authority is mandatory in USA. The devices that are listed and subsequently cleared are examined for classification and based on classification they undergo appropriate regulatory approval.

Medical device industry needs to follow the general GMP guidelines, to ensure product safety in design and performance. These guidelines are prevalent for almost all the industry. In December 1978, the FDA Good Manufacturing Practices (GMP) Regulation became effective. This regulation established the quality system requirements for products regulated under the FDA, including medical devices. In 1990, the Safe Medical Devices Act (SMDA) was amended, adding design to the GMP requirements that was based on ISO 9001. With the
SMDA amendment, the GMP covers the design, manufacture, packaging, labelling, storage, installation and servicing of all finished medical devices intended for human use. Some devices of Class I are exempt from GMP requirements.

There is stringent control of adverse event reporting system related to device use in USA. This is no different from adverse event system reporting of drugs. Prevention of Iatrogenesis is one of the main focuses of regulatory control, and a documented system of reporting serves as a valuable data for post marketing surveillance of devices. In the world device recall is not infrequent, based on increased adverse event reporting- thus regulatory control of this aspect is necessary.

Pre-marketing controls for a medical device may include: clearance to market by 510(k) or approval to market by Pre-Market Approval (PMA) document. The majority of Class II medical devices are cleared to market by submission and FDA review of a 510(k) Pre-Market Notification submission. The 510(k) submission identifies characteristics of the new or modified medical device as compared to a medical device with similar intended use, currently legally marketed in the United States. In technical terms existing legally marketed device is referred to as the “predicate” device, to which a new device or modified device is compared before clearance.

Post marketing controls include Device Listing, Medical Device Reporting (MDR), Establishment Registration and Quality System Compliance Inspection.

Devices classified by the FDA do not always correspond to the equivalent Canadian or EU device class, but in the majority of cases they will correspond. The following table 4.7 is made to illustrate the general relationship among the device classes of the three jurisdictions, based on researchers understanding of the systems.

FDA applies increasing levels of controls for increasing risk of devices:

Class I : The class I devices are subject to General Controls, which include establishment (manufacturing site) registration; device listing; Pre-market Notification (510(k)); records and reports; and Good Manufacturing Practices (GMP).
Nearly all Class I devices are exempt from 510(k) requirements and many from GMP. All Class I device utilizing software are subject to design controls.

Class II: Class II devices are subject to Special Controls, in addition to General Controls. These Special Controls may include additional requirements related to post-market surveillance, labelling, patient registries, guidelines and mandatory performance standards.

For life-sustaining and life-supporting Class II devices, the FDA prescribes the Special Controls necessary to provide adequate assurance of safety and effectiveness and describe how such controls provide the required assurances.

Table 4.7 Analogy of US FDA Device Classification with Canada & EU

<table>
<thead>
<tr>
<th>US FDA Device Classification</th>
<th>Canadian Medical device Regulation classification</th>
<th>EU device classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class III</td>
<td>Class IV</td>
<td>Class III</td>
</tr>
<tr>
<td>Class III</td>
<td>Class IIII</td>
<td>Class II B</td>
</tr>
<tr>
<td>Class II</td>
<td>Class II</td>
<td>Class II A</td>
</tr>
<tr>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
</tr>
</tbody>
</table>

Class III: Class III devices are subject to Special Controls, in addition to General Controls but require the completion of a Pre market approval before a device can be marketed. ‘Premarket approval (PMA)’ is the FDA process of scientific and regulatory review to evaluate the safety and effectiveness of Class III medical devices. Due to the level of risk associated with Class III devices, FDA has determined that general and special controls alone are insufficient to assure the safety and effectiveness of Class III devices. Therefore, these devices require a pre-market approval (PMA) application under section 515 of the FFD&C Act in order to obtain marketing clearance.

The regulatory aspect of medical device import can be seen in the practice of registering the United States agent for the particular importing activity by listing the device in US repository and depending on quality system requirements a Premarket Approval.

*Medical device risk management in US regulatory model*
There is a strong focus of regulatory control in USA. The international standards for risk management ISO 14971 and biocompatibility ISO 10993 are accepted by US governmental agencies. Under SMDA, manufacturers and distributors must submit Medical Device Reports (MDRs) when they become aware of information that suggests that the device –

(a) Caused or contributed to a death, serious illness or serious injury; or
(b) Malfunctioned, and there is a probability that if the malfunction were to recur, the device would cause or contribute to a death, serious injury or serious illness.

Though the adverse event of medical device reporting requirements is similar to the EU or Canada, there are differences. The FDAMA revoked the need for distributors of devices to report adverse events to the FDA and or manufacturer. Instead, distributors are responsible for record keeping of complaints and make the records available to the FDA upon request. FDA has the authority to recall a medical device.

The manufacturer is made responsible for all post-market surveillance on certain products that have been designated by the FDA, while considering the premarket approval process. FDA oversees that manufacturer is gathering information on a device’s performance in the marketplace, with a view to ensure that the device’s performance meets safety and effectiveness requirements and that improvements can be made where required. Similar post-market surveillance activities are required under the EU MDD and Canada’s Regulations.

4.10.4: Summarising Medical Device Governance: A Comparative Overview of EU, Japan & USA Models

For quick overview of medical device governance in the three entities we can refer to the Table 4.8 (based on the earlier discussions), which is detailing a comparative statement on medical device regulatory efforts in three entities. The following points are made to convey the overall view on medical device regulation.

- There are visibly similar requirements for registration of medical devices & regulation of the medical device industry by way of licensing and vigil.
- All classification of medical devices based on risk of use, there is graded regulatory control based on risk.
- Regulation of imported device through registering local representative or also by registering the foreign manufacturer is practised.
- Quality management systems and risk management systems are in place except for medical devices class I.
- Certificates of ISO 13485 and ISO 14971 are required or recommended.
- A mechanism of adverse event reporting in all three entity is present.
- There is a procedure of recall or market withdrawal of products.

### Table 4.8 Overview of Medical Device Regulation in EU, Japan & USA

<table>
<thead>
<tr>
<th>Competent Authority</th>
<th>EU</th>
<th>Japan</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Device &amp; Cosmetic Competent Authority of each States</td>
<td>Medical Device &amp; Cosmetic Competent Authority of each States</td>
<td>Ministry of Health, labour &amp; welfare -Pharmaceutical and Food Safety Bureau, - Office of Medical Device Control - Office of Compliance</td>
<td>FDA (Food &amp; Drug Administration) CDRH (Center for Devices and Radiological Health)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device class</th>
<th>Risk stratified I, IIA, IIB, III,</th>
<th>Risk stratified I, II, III, IV</th>
<th>Risk stratified I, II, III</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Types of Licences</th>
<th>Registration of Representative Authority (Initial Distributor in EU)</th>
<th>For local manufacture and Foreign Accreditation of Foreign industry License for Marketing Authorization Holder License for Retail and</th>
<th>Initial Registration of Device Manufacturer including Foreign Manufacturer and Initial Importer shall be registered into FDA File. Annual Device Listing of the manufacturer shall be provided to FDA/CDRH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration of Manufacturer and List of Device Category and</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Product Rental Business of devices.
License for Repair

### Quality Systems
**Quality Management System (ISO13485) Certification**
At every application for Certification or Approval for Medical Device audit is done.
21 CFR 820 QSR (Quality System Regulation)
Almost same to ISO 13485 as used in EU

### Adverse Event
**Incident Report and Recall and Vigilance Guideline defined by MEDDEV 2.12-1 Rev.5**
Adverse Event or Incident Report is detailed in Chapter 10 of PAL Enforcement Regulation
Medical Device Reporting : CFR 803
Manufacturers are to report an adverse event to FDA within set time limits

### Device Recall
**Field safety Corrective Action (FSCA) and Field Safety Notices (FSN) regulate all device recall process**
Marketing Authorization Holder must report to Government Prefecture and PMDA in case of Recall and Removal Class I is most urgent and important than class II , III
Recall is governed by FDA
There is Classification of Recall category.

There is still need for reforms related to premarket approval of various devices as expressed by various papers, based on transparency and time constraints[^36]. The details of these intended reforms are subject of our future research. Based on learning of the three major regulatory
regimens of medical device, present work will review the domestic situation in India in chapter 5.

4.11: Conclusion

Distinguishing regulation & governance is tricky, though not an impossible task. In general terms regulation translates to government action in the form of laws and notifications with the objective of directing private action for a specific purpose or with a certain aim. Regulations are enforced by legislations brought about by a debate or consensus in most democratic institutions. Regulation might be seen as incentive based like reward for a certain set of acts or punitive like fines or penalty for another set of acts.

Governance on the other hand is a more inclusive process which involves both the state as well as the stakeholders to arrive at a perceived common goal. Governance can be viewed through the prism of policies & practices and the institutions.

Governing technology is tricky, and primary question relates to multiple domain of safety, ethics, long term effects and economic viability. Justifying continued use of a particular technology through a process of governance involves questions from all these domains.

As technology per se is changing very fast regulations get obsolete. It needs to be seen whether one should put the regulation in place and develop technology around it or vice versa.

Effective regulation and governance of healthcare technology in general and the medical devices in particular is a complex issue emanating from the interaction of multiple stakeholders, technicalities of the subject and lack of fixed universal principles. There are local issues of infrastructure and enforcement which has to operate in conjunction with certain agreed upon or prevailing global standards of operation. Concerning Indian national regulatory framework for medical device governance, it is amply clear that most medical devices originate in distant countries where the local regulations may be different and regulating import of these devices and monitoring appropriate use in Indian context is a herculean task given the odds that legislators and regulators may not be aware of all the technicalities involved. In India one important regulatory challenge is lack of appropriate laboratories where manufacturer’s claim can be verified. There is further difficulty in India
to have post-marketing surveillance for safety and hazards emanating from use of various devices.

The following excerpt from the 2010 Annual health report\textsuperscript{37} of MHFOW may be cited to conclude the present chapter: “....given the inappropriate and inefficient use of technology resulting in increased biological and economic costs there is a need for guidelines, technology audits and cost-effective studies. Creation of an institution on the lines of the National Institute of Clinical Excellence would help develop evidence for technological assessment and decision-making.”

\begin{enumerate}
\item Principles for Good Governance in the 21st Century Policy Brief No. 15 - Institute On Governance, Viewed on 13\textsuperscript{th} April 2013 Ottawa, Canada (www.iog.ca/publications/policy briefs)
\item Novotny, T E , Global governance and public health security in 21\textsuperscript{st} century, Viewed on 13\textsuperscript{th} April 2013 (www.cwsl.edu/content/journals/Novotny)
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WHO and Ministry of Health, Labour and Welfare, Japan, Viewed on 12th April 2013 (http://www.wpro.who.int/health_services/service_delivery_profile_japan.pdf)

31 ibid


33 Mike Winegar, Toxikon corporation: Obtaining Japanese medical device regulatory approval: recent changes and their impact on you, 2005, Viewed on 12th April 2013 (medicaldeviceresourcegroup.com/perspectives/dec05_tox.pdf)

34 The official FDA site, Viewed on at 12th April 2013 (http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/overview/default.html)

