Chapter Four

Technological Advancement in Music Recording

Technology plays a vital role in the daily lives of almost everyone in the world today. One of the significant contributions which have been granted to the world by scientific innovations is the technological revolution which has resulted in a multiplicity of trends in the contemporary societies. These trends have already conquered our daily lives. The influences of technology in the fields such as environmental, medical, communication, and transportation have impacted on the field of arts as well. Consequently, the mainstream methods and practices of aesthetic production, performance, distribution, and consumption have been dramatically revolutionized.

It may well be said that almost all the forms of musical performances and productions in this technological era radically differ from the traditional methodologies. These radical technological developments not only challenged scientists but also they made powerful impacts on the composers, musicians and the different audiences. This trend cannot be considered merely as a musical development alone. Rather, it is at the same time a process which has inter-dependence on other scientific innovations which have contributed to the development of the field of acoustic. New technological inventions such as the use of telephone significantly impacted on the organization and reproduction of sound. In addition to the telephone technology, the other electronic inventions and innovations such as “Vacuum tube, Transistor and Microprocessor” have also made powerful impacts on the development of music and sound recording in the world from time to time. Indeed, the field of acoustics and recording sounds has overwhelmingly become an important part of the contemporary society.
In general, sound recording is a process which involves the sub-processes such as capturing data, precede signals through different electronic equipment, moderating and storing on a proper medium and releasing the captured data towards the audiences in a number of ways and means etc. The process of recording music involves a forwarding pattern, but the same pattern goes backward while listening to the recorded data according to its technological progression.

However, the process is not seriously affected by the advancements of new inventions and technological tools. Some of the equipment, environment, features, procedures, formats, creativity and other essential technical methods have been changed in modern technologies when compared to the early technological mechanisms. However, when it comes to the main human organs, mouth and ear, both are “analog”. Biologically, human voice results in an analog signal and the ear captures the signal in the form of an analog signal. However, the technology of storing a wave signal (basically a sound) has been transformed to digital from analog due to the advancements of new technological innovations. But on some occasions the early technological tools, methods and gadgets are incorporated in numerous ways into modern techniques for creative productivities as per their unique features.

For the sake of the convenience of study, the technological advancement of music recording may be classified under two major categories:

1. Advancements of Analog recording technology

Accordingly, advancements of music recording technologies are covered under the above two forms including the following areas:
1. Technology and its various forms
2. Space of recording (Studio and accessories)
3. Equipment and accessories (Effects etc.)
4. Recording Materials

4.1 Advancement in Analog Recording Technology

As stated in the previous chapter, concepts such as “Analog and digital” recordings are two main technological formats of storing signals or sound-data on a different medium. Accordingly, signals that are captured and stored in wave form or as physical textures are normally called "analog technology" whereas the data stored in the form of numerical or binary numbers is called "digital technology". Both forms have their own scientific characteristics which have been transformed in the course of time.

The signals are basically divided into two forms: analog and digital, each one having distinct sound utilizations in audio and music production. Indeed, both signal types are used in the contemporary music recording contexts.

In the analog recording process, the analog sound which is created by a musical instrument or human voice is transferred to an electrical signal by using an electrical transducer (microphone) and then it is stored in/on a relevant medium (wax cylinder/disc/wire/on a tape medium). The recorded signal of any given sound is reconverted to an electrical signal by means of a transducer (Speaker) in which the electrical signal is transformed into an analog one while listening.

Analog recording is highly considered to be an auditory tool for sound recording since the earlier times. In the earlier mediums (wax to tape) sound signals were stored as analog data. Some innovative recording equipment such as Graphophone, Phonograph, Gramophone, Daily graph, Magnetophone...etc. were used for that purpose. These
equipment categories were employed to store data on wax cylinders, vinyl discs, wires and audio tapes. Due to some practical reasons, inconvenient usages and limitations of the early technologies of sound recording such as Graphophone, Phonograph and Daily graph began to disappear while the gramophone survived even after that due to its durability and convenient usage as a medium of storage, unlike most of the traditional technologies. All those mechanisms described above were used to record sound in Monologue format.

As a creative tool, the early analog recording technologies posed critical challenges to those who were engaged in sound recording industry. Operating and handling such machines and overcoming issues of recording were not easy tasks, compared to the present. In general, these were large in size and were more expensive. Equipment basically employed for sound recording was originally invented as analog devices in the Analog age. Thus all recording technicians had to have knowledge on troubleshooting them. Additionally, the admirable duty of the people who were involved in recording at that time was successful in using experimental methods in order to overcome the technological limitations in a creative manner. Due to the above mentioned practical as well as technical issues and limitations, the present day observer is able to identify the extent to which the early recording artists and the technicians were successful without having a developed technology.

4.1.1 The Age of Mechanical Sound Recording

Recording sounds using the early devices and technologies was not an easy task at all. Music or the sound was recorded simultaneously (direct to disc). The playing performance was captured by the recording horn of the cutting machine and was subsequently cut into wax or shellac materials according to the acoustic pressure produced by the stylus. Performers had to stand closer to the recording horn and were supposed to play or sing aloud before the recording horn since there was not any
mechanism to amplify the sounds generated by the vocalists and/or the instruments. As mentioned above, the practice of standing a group of singers just before the recording horn impacted negatively on the instrumentalists, and sometimes raised difficulties to play properly and freely. At the time of speaking, the concept of recording studios did not exist as in the present day. Rather little overcrowded rooms were allocated for recording music. In some instances, even the hotel rooms and lecturing halls were arranged suitably for recording in addition to the outdoor recording practices. Without having a proper environment suitable for recording had resulted in a number of practical issues which affected recordings. There had not been any method to control the atmospheric room temperature or humidity which also resulted in impurities and bubbles on the medium in which the recordings were stored, and this situation led the stylus to jump. Similarly, due to uncomfortable temperature and heated conditions of the early studios the wax blanks remained soft².

Due to the technical drawbacks and environmental and contextual issues, the recording stylus could only be moved side to side but not upside down in some cases. Projecting loud (noisy) sounds to the recording horn further led to make the cutting stylus break in to an adjacent groove³.

Moreover, the only method which was available at this time to mix sounds was arranging instrumentalists in different places with various distances⁴. Distortions arose because of the loud sounds which in turn resulted in a low quality output. There was not a single mechanism to avoid background noises and distortions. Certain types of instruments such as pianos could not be used to record easily due to the mentioned issues⁵.

4.1.2 Electronic Recording with Microphones and Amplifiers

Inventing the improved “Triode Vacuum tube” by Lee de Forest in 1906 and the “Condenser microphone⁶” in 1920s were two of the most influential factors which have
resulted in further developments of sound recording industry (Microphones which were used in the early 1920s were smaller devices than the telephone mouth pieces. The Carbon technology was employed to manufacture microphones. Bell Telephone Laboratory engineers made the Condenser microphone as an alternative to the carbon microphones of a low quality). The “Audion Vacuum tube” paved the way for many electrical inventions like electronic amplification devices. The technology of electronic amplification was initially developed for use in radio around 1906. Subsequently, high fidelity sound recordings were introduced to replace and/or complement the quality of mechanically or acoustically recorded phonograph discs since 1924. The recording horn which had previously been used in the field was replaced with a range of newly invented utensils such as microphones and amplifiers. In addition to that, outputs of several microphones could be mixed together with controlled sound signal sensitively, ultimately to come up with a smooth sound. Accordingly, recorded sound could be subjected to fragmentation in order to produce a high fidelity sound quality. Nevertheless, the growth of “moving coil loud speaker” allowed the play back process to be electrified in a qualitative manner. Due to a number of reasons including the lack of an advanced technology in the earlier times of Phonographs or Gramophone recordings, there were no facilities and methods to edit and record the recordings (sounds) part by part.

“Victor” was the very first company to offer a new technological solution under license in 1924. They introduced an electronic recording technology which they had called "othophonic recording" which meant "straight sound", thus replacing the acoustic recording. Further, Victor also introduced an electronic “Pick-ups” technology that replaced the acoustic diaphragm and horn of the phonograph. Likewise, the Western Electronics Company and the American Telephone and Telegraph Corporation (AT&T) introduced electronic phonograph recorders for the sound recording studios.

The leading contemporary technological advancements mentioned above influenced the development of the concept of “two-room studios” in which music was generally
recorded. One room of the studio which included microphones was allocated to musicians for their performances while another room was used as a 'control room' where the engineer could observe the performances by means of recording consoles speakers under strict and qualitative conditions. The control room was separated from the living room by a partitioned glass. Musicians carried out several rehearsal performances before the final one in order to overcome the technical drawbacks. The entire recording process had to be restarted if someone did a mistake during the performance. In the course of time, the industry of mass distribution of recorded music became a profitable business due to the use of electronic recording devices with high quality recording facilities which were absent in the previously used technologies. Thus, not only the technological aspects, but the materials that were used also were subjected to significant transformations.

Even though several technological advancements took place in this period, some limitations were still prevailing. Because of the physical limitations of 78 discs, the length of the performance had to be limited to three to four minutes. In the same manner, the low frequency rates, out of balance throughout the performances made negative impacts on the aesthetic quality of the final production, in addition to the various other factors such as pops and the noise of abrasion of the cutting stylus.

4.1.3 Electronic Recording of Music and its Outcomes

The electronic recording technology has significantly resulted in a number of trends in the music field. Compared to the earlier acoustic (non-electrical) recordings, this new wave made it possible to listen to the details of music in the disc due to the fidelity. Such discs became highly popularized among the music listeners enabling the music industry to expand its scope beyond the existed limits.
The most visible benefit which the musicians could entertain as a result of this development was that it provided them with various novel technologies and methodologies to record and edit musical compositions. As the use of microphones became famous among the musicians, they no longer had to gather around the recording horns. Furthermore, rather than providing forceful voices as in the previous methods of sound capturing, vocalists and musicians were able to render their voices and instrumental accompaniments even more softly.

Correspondingly, recordings that were hitherto limited to recording studios could be performed outside studios locations in concert halls, theatre hall and open houses. This trend influenced Western Classical music compositions such as symphonies, operas, and other forms etc. Live performance-based recording genres also came to be seen in the music industry.

On the other hand, the development of radio broadcasting technologies largely affected the way in which people experienced their music habits and appreciations. Electronic equipment and recording discs significantly led to a demanded situation within the radio based public audiences in terms of the radio technology (the new conception of wireless radio broadcasting was invented by the Italian inventor Guglielmo Marconi). Due to the amplification possibilities, discs that were recorded by means of mechanical technology could be broadcast with some modifications of audio frequencies.

By all means, the development of radio technology also influenced the development of electrical recording from around 1906. As Chanan has correctly pointed out, Lional Guest and H.O. Merriman were the leading British scientists who presented the very first public electoral recording in 1920. They have recorded the burial of the Unknown Soldier in Westminster Abbey on Armistice Day. However, the quality of the recording was poor.

Even though the electrically recorded discs had already been introduced, there was not a compatible technology to play those discs. As a consequence of employing acoustic
machines for playing electrified discs, the expected outcome of high-fidelity sound quality could not be obtained. Even though it was possible for the broadcasting companies to broadcast those discs with high-fidelity sound quality without having hash effects due to the amplification possibilities and electrified playback machines, the general public lacked a common set of mechanisms failed to obtain a proper experience of electrified sounds using their normal acoustic playback machineries 16.

4.1.4 Invention of the Recording Console

As it has already been mentioned in the above discussion, arranging instrumentalists in various places at various distances within the recording environment was the only available method to mix sounds before the invention of recording consoles in the 1950s.

Recording Console is the most important equipment which is also known as audio production console, mixing board located in the recording studio. The ‘recording console 17’ has a number of mixing features which are helpful not only to change and modify the input levels of different instruments but also to control mixing balance of the overall levels of the performance before the recording process starts (a simple mixing console was used in the initial stages. The console had both large knobs and switches. Large knobs were used to adjust the individual input levels, one of them was used for the overall level. The other switches were used for several purposes of obtaining sonic sound quality. With the gradual development of new technological innovations, advanced mixing consoles are still being developed). In the early stages of the field, only the simple mixing methods such as flattening out the peaks of microphones were used to record signals. On the other hand, the invention of multi-track recording technology led to the introduction of large-channel mixing consoles with increased channels (from 8 to 64 channels etc.) in addition to Equalization capacities etc. In previous stages, mixing consoles with equalization facilities were only used to equalize the recorded signals.
4.2 Magnetic Sound Recording

The invention of the technology known as "magnetic recording" also paved the way to many dramatic transformations in the field. The technology of magnetically recording sounds which had begun to take place during the time of the World War II can be considered to be the important development in the recording industry. Even though the technology of magnetic recording has led many technical inventions like "Telegraphone" around 1910s, it cannot be directly considered as the most influential factor in the field of recording industry, especially where music is concerned. However, recording music on a tape changed the earlier methods and procedures of recording sounds and has resulted in a wide range of innovative advancements compared to the other techniques which were hitherto used for the same or similar purposes.

In the process of magnetic recording, the analog wave or the sound signal passed by the microphone or any line in cable is transformed into an electrical signal. Subsequently, it is stored on tape medium, in the form of magnetic remnants. While the playback is in progress, the stored magnetic power is reconverted to an electrical signal or energy\(^{18}\). In this process, the sound quality of the recording signal depends both on the head of the recording machine and on the recording medium. However, in the earlier times, the ultimate productions did not consist of high quality sound due to the poor quality of tapes and the materials and equipment. The sound waves were first recorded on Iron wire followed by steel ribbons according to the magnetic principle. There were some experimental measures aimed at the use of paper-backed tapes, the most significant innovation was the use of plastic which was coated with magnetic materials. This was developed by German engineers during the 1935s. However, the tape materials were commonly popularized in the filed as a storing medium after the World War II\(^{19}\). Some early tape mediums were manufactured using different sorts of chemicals. In the timeline, the plastic tapes were covered with a coat of Ferromagnetic materials followed by different chemical particles of metallic oxides (Iron oxide (II) - FeO, Iron oxide (III) -
Fe₂O₃) in order to improve the quality of the output. The sonic sound quality Chromium dioxide was applied as the most common particle on the tape surfaces. Similarly, the speed at which the tape transports both in the recording and play back processes has to be remained the same. If the speeds differ from each other, the pitch, rhythm and the duration of the recorded composition may be severely affected. If the speeds differ from each other, the pitch, rhythm and the duration of the recorded composition was liable to be severely affected. However, the speed and the pitch changes were later employed in numerous ways to come up with certain tape-based effects.

Indeed, the introduction of commercial recorders, and the quality of the machines and tapes were further developed by the Telefunken in Europe and Ampex Company in the United States. All the recordings were initially stored on 1/4 tapes and then the technology evolved into different widths such as 1/2”, 1’ and 2’ with different speeds. It is important to note in this regard that the original use and functions of these tapes were devoted to maintain a soft back-up to be directed to disc recording and to the prerecorded radio broadcasting environments.

### 4.2.1 Early Tape Track Counts

Tape track counts were also depended on the technology. However, a numbers of track counts were introduced according to the existed technology as follows;

1. **Full track** - the simplest common tape. This possessed only one track in one direction.

2. **Two track mono** – two tracks were allocated with the tape to record in a single channel at one time since only one head was fixed in the players. After it is used for once, tape flipped to record the other side.
3. **Half-track**—these tapes had two channels and could record either individually or simultaneously.

4. **Quarter track stereo**—this is a stereo tape in which track one and three are recorded as stereo sounds in the forward directions. Upon flipping the second and fourth tracks could be recorded in the reversed direction.

5. **Quarter inch Four track multi-track discrete**—these were multi-track tapes that could record four tracks (even four different tracks also) simultaneously, in one direction. Thus it did not have "B" sides.

6. **Half inch Eight track discrete**—Similar to the above tape, but it incorporated eight tracks in one direction.

However, with the development of multi-track recording tape, track counts were increased to fulfill the technological and commercial demand of tape recording.

Even though the recording materials were transformed from discs to tapes, the situation of the recording industry as a whole remained unchanged for a considerable amount of time. The introduction of two track tapes drastically changed the way in which the recording mechanism took place. These types of recording sessions were commonly known as “live-to-2 or sound on sound recording” and were used before the multi-track technology came into existence. The process of live-to-two sessions is similar to capturing the singer’s voice according to the pre-recorded instrumentations. After recording the instrumentalists, singer has to render her/his voice simultaneously, with the initial track was playing back. Thereafter, both performances (Singers and instrumentalists) are recorded together into a new tape to form a single composition.
The major improvement of the tape recording is the beginning of the concept of editing in a creative manner that was not possible at all in the previous recording technologies. This is a great advantage of the field of recording. As a result, the best segments of more than one recording were possible to be cut and spliced in order to come up with a finest production. Unlike the earlier practice of cutting live music performances simultaneously into the discs was radically changed so that the sound was first recorded on tapes and then the edited pieces were pressed innovatively onto a Vinyl disc before releasing the ultimate products to the market.

On the other hand, the introduction of portable “compact cassettes” for music recording (cassette medium is used another purposes such as dictation also) by Dutch company called Philips in 1963 also contributed to the gradual development of recording industry. Most of the artists released their popular music albums to commercial market by using compact cassettes as a storage medium.

The other advantage of the tape medium was the possibility of recording the sessions of music performances on the discs which were longer than 16 inches. They were limited to three to five minutes but had the capacity of capturing high fidelity sounds. In addition to the earlier mentioned traditional effects which were related to various environment or halls such as reverberation and echoes, experiments were conducted on how to generate especial effects like what is called “Chipmunk” using several speeds of tapes, a later benefit which the traditional gramophones failed to produce.

According to Daniel M. Thompson’s book and also to the musicians whom the researcher interviewed in Sri Lanka, they always tried to point out the unique characteristic features of “live-to-2 sessions” than the multi-track recording sessions. Accordingly, the advantages of these sessions are time efficiency, ability to capture the natural and spontaneous interaction between the musicians and the respective composition etc.
These points can be considered as positive comments within the technological limitations. But, under the technological advancements and the demand to recorded music, these practices inevitably change according to the commercial market. Thus, no one can describe that the former technology was better than the later technologies, because advancements provide responses to previous limitations.

Furthermore, the new innovations and developments in the field in question have also resulted in a dramatic transformation of the related professions. The traditional "sound recordist" or the "sound technician" whose duty was to involve in mechanical sound production transformed to "sound engineer" in the magnetic sound era. A number of creative characteristics were also assigned to this position. Comparatively, the task of the sound engineer was entirely different and complicated than that of the sound recordist: capturing every nuance of sound and editing the perfect selection for the final production.

### 4.2.2 Adding Artificial Effects to Recorded Signal

With the above-mentioned new developments, the sound engineers have made attempts to complement the original music by adding some additional sound effects (reverberation) in composing the final music production to make sure that the audience feel that they are listening to a live performance which is being naturally performed in an environment like concert halls as well as additional effects add fullness and the richness to the recorded sound wave. Before the invention of the concept of recording studios, natural acoustic qualities attached to the recording rooms were sound capturing. However, when properly designed sound studios were introduced with sound-deadening materials, some extra devices had to be invented and used to reproduce the special sound effects. Even though there were properly constructed studios, some performances were recorded in large performance halls in order to capture the acoustic effects. However, this practice had been challenged by a large number of practical issues when it came to real sound recordings. Echo chambers were permanently set up in these studios as strategy to
overcome some of these obstacles. Accordingly, the echo chambers were utilized to add artificially generated reverb and echoes to the final tape. As a part of this process, the edited recording signal was sent to the chamber through speakers and the reverberated signal was re-transferred to the control room via a microphone. Finally, it was recorded on a tape or a disc.

However, the leading sound recording technicians took initiatives to introduce sound effects such as tape echoes, reverberation, tape looping techniques and tape delays by using the tape medium and the tape recorders in order to make the ultimate sound production complete and rich in quality. The tapes were used as materials to come up with the effects as follows:

### 4.2.2.1 Tape Echoes

Echo refers to the clear occurrence and the gradual decay in amplitude which is a result of repetition of sounds. The output wave signal of the playback sound is again fed to the same machine by which it was created to create this effect, and, the tape simultaneously records and plays back the recorded sound. The length of the delay of these sounds depends on the distance from the record head to the playback head. Echo is produced by continuation of this process without interruption.

### 4.2.2.2 Tape Reverberation

Reverberation is the process in which a minute of fractional time delay takes place with regard to the perception of sound waves while they bounce back from the relative surfaces of varying distances in a gin listening context. Echo and reverberation have some tiny differences between them. The effect called reverberation is produced by utilizing what is called “Spring Reverberation”, i.e. a simple device made of metal. The wave signal is transmitted through the metallic coil of that device and is detected at the
other end. In order to create the "ghost sound" effect, the signal is delayed a bit. The reverberation effect is indeed a result of the thickness of that metal\textsuperscript{32}.

### 4.2.2.3 Tape Delay

Tape delay is also another type of echo. It is actually the time gap between repetitions. The existence of at least two record players is essential to create this effect. Generally, a sound is recorded on one machine and played back on the second one. This results in a considerable delay between the two occurrences. While the first machine plays the sound, the second one records it simultaneously. In this process, an extended echo is created between the repetitions\textsuperscript{33}. The time delay can be controlled by altering the tape speed (which should be the same on both tape recorders) and the physical separation of the two recorders\textsuperscript{34}. However, in the course of time, a number of minor utilities are developed to create special sound effects.

### 4.2.2.4 Tape Loops

The tape loop functions as a nonstop cyclic movement. Both ends of the tape have to be spliced in order to create a tape loop. The tape loop technology was utilized both as a way of creating effects and as a means of creating nonstop rhythm circles (to produce repeated phrases, patterns and rhythms) in the early recordings\textsuperscript{35}.

It is also important to note here that the gradual increase of techno-scientific inventions has become one of the major reasons why the previous technological devices were replaced. It is due to the same reason that a bulk of new accessories and circuits are now available. Thus, newly emerged transistor functionally became a substitute to the tube and it made the processes of amplifying and mixing units easier than in the earlier times. As the technology of sound recording further developed, the amplifiers and mixing
consoles were introduced to the market with versatile fashions including all levels of controls and other fictional features\textsuperscript{36}.

Not only the tape but the LP discs were also utilized to create effects like echoes, reverbs…etc. during the 1970s. The process of crafting such effects is as follows:

1. To create Pitch changing effect - to play the disc using turn tables with high speed ranges
2. Reverse effects - play back the disc using with electronic pickups
3. Echoes - arranging multiple pickups to produce echoes\textsuperscript{37}.

\textbf{4.2.3 Invention of the Stereophonic Recording}

Stereo, otherwise known as "stereophonic" sound technology is a special type of multi-channel recording which began to take place since the 1950s to simultaneously record and playback sounds in two channels by using two directional microphones or other complex techniques with sound speakers. As a major development in the field of recording and audio technology, this has the capacity to produce sounds which have the effects of natural or normal sounds experienced from various directions. Before this mechanism took place, all sounds were recorded and played back in one channel known as "Monophonic" sounds. With the growing commercial demand for stereophonic sounds, the recording industry and engineers attempted to record and distribute high fidelity and two channel stereophonic sounds on discs\textsuperscript{38}.

“Bi-channel” recordings on the discs, which were used before the Stereo recordings, were introduced by the Bell Telephone Laboratories in 1932 though they were not released to the mass market until 1960. However, a company in the United States called Livingston Audio Products had already released some Stereophonic open reel tapes and consumer recorders by 1954. Another type of Stereophonic method was invented by the audio
engineer Emory Cook in 1958. The mechanism was known as “bynatura” recording where phones were used to separate the channel of a two channel recordings. Likewise he had developed the system with two concentric groves records in 1951 together with a special dual pick up tone arm to play them\textsuperscript{39}.

4.2.4 Multi-track Recording

In the field of recording, multi-track recording can be cited as a commemorational development of the field of recording. However, the multi-track recording process changed the fundamental environment of the music recording and composing. As opposed to the early means of recording the entire composition with the orchestra at the same time, in multi-track individually recorded tracks ultimately became a music composition. Similarly, according to the nature of multi-track recording, balance of instruments and mixing could be done later as per recording engineers’ wishes and also musicians could compose music and modified even during the process of recording. Multi-track recording also expanded time and space issues that musicians faced with early technologies.

Research on multi-track recording can be traced back to the experimental recordings of the great musician and guitarist Les Paul in the early 1940s. Raymond Scott had invented the earliest multi-track tape recorders with seven and fourteen tracks on a single reel of tape using multiple tape heads even before the former\textsuperscript{40}. However, it is the equipment invented by Les Paul in 1956 which is considered as the ideal prototype which had the capacity to record eight parallel tracks on a tape with two inches (2”) in width\textsuperscript{41}.

The developments which have taken place with regard to multi-track tape recording led the music recording field to a new direction by subsequently adding a new dimension to the world recording industry and changing the traditional methods of recording with the entire orchestra in the same time in recording studios. Similarly, mixing was done at the
same time of recording. Unlike the earlier practices, the multi-track recording technology has made it possible to the musicians involved in the field to record the individual fragments of instruments separately at any time and then mix and enhance those tracks when the final product is revised for release. Technically, the process is known as "overdubbing". The overdubbing facility has provided all the musicians and the recording engineers with an opportunity to carry out their duties in a more relax way. During a given multi-track recording session, the basic rhythm tracks (drums with percussions and Bass guitar) are initially recorded and then followed by other tracks synchronizing with the already recorded tracks to match the rhythm.

As opposed to the “live -to -2” recording process, in the multi-track technology, the mixing of a recorded composition takes place once all tracks have successfully been recorded. In this case, all the necessary effects and other editing features are finalized and then the composition is prepared to be released as the ultimate product\textsuperscript{42}.

Even though the possible number of track counts was limited to two, four and eight in the earlier stages of sound recording, the number began to gradually increase after 1970. Parallel to these developments, microphones developed with modern technological features and other external effects devices were introduced to the recording studios from time to time\textsuperscript{43}.

As an outcome of the modern technological revolution within the field, sound recording studios have to be updated and upgraded with many modifications to address innovative techniques and musical genres. Recording studios have been equipped with isolation booths for several acoustic instruments especially for multi-track recording.

As stated above, technological development has also introduced a new terminology to audio recording industry. For example, the term “Mixing engineer” refers to a professional whose duty is to mix multi-tracks to offer an aesthetically enriched and
properly balanced recorded composition to the audience. Similarly, it has also resulted in some new professions such as "recording engineer" and "mixing engineer", thereby contributing to the widespread development of the field. Similarly, apart from musicians, a massive work is done by recording engineer to give a fine aesthetic experience to audience.

4.3 Music Composing Techniques

Given such technological limitations, these kinds of technological developments have resulted in some music composing techniques which are generally known as: Musique Concretre and Elektronische Musik and Music Collage.

4.3.1 Musique Concretre

Musique Concretre can simply be defined as an early composition technique in which ordinarily natural and unnatural sounds were used to compose according to a contextual meaning on the tape medium with the aid of the above mentioned tape-based effects. These compositions were mostly employed in the early theatrical productions.

4.3.2 Electronic Music

With the introduction of electrical sound recording, another trend of music composing using electrically generated sounds came into existence by replacing the Musique Concretre technology. The new trend was commonly known as Elektronische Musik that employed an entirely synthetic environment, creating sounds merely from the electronic sound generators.
4.3.3 Music Collages

Music collages is similar to paper collages technique. However, the major difference between the two techniques is the medium used by each. Similar to combining small papers to create a paper based collages, multiple sounds can be combined to widen a composite sound. In Collage technique the sound loops, transposed sounds, natural and non-natural sounds as well as reversed sounds are used to obtain proper environment quality of the creation\textsuperscript{46}.

4.4 Limitations

Even though there had been several advancements from time to time, recorded mediums still suffer from various disadvantages. Following are some of such issues involved in analog recording:

1. Gramophone recordings may be damaged very easily
2. Editing difficulties
3. Poor signal to noise ratio
4. Where the tape medium is concerned, the tape degrades with each progressive play over the tape head (Tape hisses)
5. A serious attention has to be paid to maintenance.

Despite these issues, the vast majority of the audiophiles especially prefer analog recordings considering it as a more accurate and a qualitative method with a certain depth than the digital recordings.

However, the question becomes complicated where the scientific facts are concerned. The reason why people feel analog sounds are better than digital is the possibility of using additional sounds. Even though both analog and digital waves are captured in a sound proof environment called sound recording studio, additional sounds generated by
different circuitries of recording machines and other equipments also accumulate while processing the signal into analog medium. There is a more developed method to reduce such additional noises in digital recording though there were no such measurable techniques to reduce noises. But, some qualitative methods were found to reduce noises of analog tape such as Dolby (Dolby is a specific technology of noise reduction of tape recording which was introduced during 1960s. Dolby A, Dolby B and C, dbx NR, Dolby SR, HX pro are some methods used for reducing noise)\textsuperscript{47}. Due to the accumulated external noises with recorded signals, most of the audiophiles tend to think of it as an additional feature of the analog mediums or the process in general.

4.5 Advancement in Digital sound Recording Technology

In the 1980s, the term and the concept “digital” as opposite to “analog” came into existence with enormous scientific developments as a form of technological advancement. Form then onwards, the principle and the form of technology are highly employed with the fields of data manipulation and communication as a widespread technology. Discovering the “Computer Processor and the Chip technology” for data installation” could be pointed out as a major contributing factor to the digital revolution. Aside from that invention of Compact Discs (CD) as a sound and advanced storing medium by the well-known company called Philips also influenced to the digital technology.

However, in the other fields, scientists who were interested in the field of music and electronics also tried out the possibilities of applying the form of digital conception for data manipulation and sound recording. Thenceforth, with their successful outcome, the digital technology is being employed as the standard form of recording and manipulating sounds in the field of music as a convenient method of the contemporary commercial environment all over the world.
Even though the recording process is similar as to analog recording, in the digital technology, as we mentioned in the first chapter, the energy of acoustic or the data generated by voice or different instruments are transformed into binary numbers (1s and 0s) using a analog to digital (A/D) converter which is also known as “Sound Card or Recording Interface”. According to the amplitude of the respective wave signal as “periodic Samples” when these signals are stored in the recording medium. The following diagram shows the entire process of digital recording and transferring process while listening. Example:-

![Diagram showing the process of digital recording and transferring process]

In the context of digital sound recording and manipulation the process is known as “sampling technology”. Accordingly, captured sounds at a given sample rate store on a digital tape or a hard disc or other medium for later processing and manipulation purposes. The process of recording digital and data manipulation is completely opposed to the procedures in which data is stored in the analog medium\(^4\).

Compared to the other early recording technologies such as analog recording, the digital recording technology introduced a vast range of effortless functions or techniques to the field of music for example editing, easy copy-paste methods, erasing, moving and adding effects etc. As far as the early tape based multi-track recording is concerned, the balance and the other elements are not possible to change once the performance is recorded on a tape. With the exception of that it’s easy for further modifications of recorded sounds.
In addition to that as obtaining pure sound quality (reduction of noise), digital sound recording is in the first position of superior sound clarity without tape hisses, pops and clicks and also the ability to make copies without losing the quality. Additional to all the above mentioned characteristics, it is easy to handle, save the marketable time in this competitive sound consuming market other than early sound recording technologies\textsuperscript{49}. According to the principles of digital recording, it has changed the way music composing and also music stored.

Compared to the editing process of analog tape, the recorded data can be lost when the tape medium is edited. In the same way the method of using splicing is a rough process that can easily result in the loss of the recorded data in tape medium to some extent\textsuperscript{50}. With these capabilities, digital technology can be considered as an advanced technological tool.

### 4.5.1 Early Mediums of Digital Recording

As in the formative years digital data is also stored in the same way of a magnetic tape called “Digital Audio Tape” (DAT) while analog tape medium in the Pulse code modulation digital audio (PCM) format. With the growing demand of the professional field of recording a new standard format called “Alesis Digital Audio Tape (ADAT)” that was created and introduced by the Alesis Corporation by using video tape (VHS) which could be record eight tracks at ones\textsuperscript{51}. However, those tape mediums didn’t popularized in the commercial field since the maintain difficulties. With the exception of these two tape mediums few years later Mini Discs (MD), Compact Discs (CD) Hard disc as well as Chips were introduced as highly developed recording mediums. As far as the process of recording, editing (looping, clipping) and mixing are concerned using hard disc mediums as storing devises is very convenient for engineers.
4.5.2 Modern Developments

In the name of this digital revolution great varieties of record players and recording equipment came to the field with integrated circuits with small and light weights compatible with the abovementioned digital recording formats than the early huge players as follows:

1. Tape material based
   - The fixed head digital audio recorders
   - The DASH recorders
   - The rotating head digital audio recorders
   - The modular digital multi-track recorders (MDM)
   - Mini-disc recorders

2. Hard Disc based recorders
   - Hard disc multi-track records
   - Hard disc and Flash memory portable studios

With the exception of those equipment, the most revolutionized and multi-tasked recording features introduced to the world recording field came to be known as Digital Audio Workstations (DAWs) that could be easily controlled even with minimum requirements with personal computers.

4.5.2.1 Digital Audio Workstations (DAWs)

Digital Audio Workstation is computer integrated software and hard disk based sound recording and manipulating environment which provides common features such as:
1. A multi-track recording application which allows editing, processing and screen mixing capabilities (even multiple sound tracks)
2. MIDI synthesizing, software synthesizers
3. Capability of integrating with audio with video
4. Capability of integrating with Networking and plug-ins and hundreds of other kind of functions can be done with these DAW systems.
5. Application of simple to advanced effects or filters, compression, flanging, expansion techniques
6. Advanced and developed noise reduction methods (process of dithering)

Furthermore, with these programs, pitch, tempo and other effects that have been added to the recorded composition, could be used to adjust or change according to anyone’s wishes.

The other significant feature of DAWs is that they provide the graphic display facility (not only one can be heard, but it can also be seen while recording and editing) of the recorded tracks and its information such as the length of sound file and its amplitude on the computer screen that was not possible at all in the analog era. Correspondingly such software provide functional keys to zoom in, zoom out, zoom in horizontally and vertically for tracks and with such features editor can easily find out the precious editing point within the track/s. Incorporating “Cut, Copy and Paste” keys in DAW software is also important for the editing purposes and such keys are employed in different editing environments.

Even though, DAWs are provided with all accessories as virtual software plug-ins, some companies have released out board devices as DAW controllers for the same functionalities. Those out board controllers can be made use of via MIDI, USB or Fire Wire protocols.
These developments provide additional user friendly, appropriate technological tools such as; Plug-ins, Instrument synthesis and samplers for the betterment of the field of recording.

However, compared to the traditional recording environments (consoles other hardware based ones) and DAWs, it is difficult to handle such DAWs though they provide same features since they are updated frequently by the respective companies. As Michael White pointed out:

“Hardware technology, one designed, would never change its signal-flow unless modified by the chief technical engineer of the studio. A recording console once learned, was learned forever. Software though, is a very different matter. While the merits of software updated to fix design flaws is great, it also makes it more difficult for the new user to learn. Each update to a software program adds new features…”  

Upgrading computer technology is the reason behind these cases. Similarly, some software applications have been designed for specific operating systems such as Windows, Linux, and MAC programs. As a result, the software users must update their knowledge on such software programs and their new features.

### 4.5.2.2 Soft Ware Plug-ins

DAW based plug-ins are also software modules which insert additional functions for the better functionality to the main application. As far as the computer technology is concerned, plug-ins are employed in different functions. Equally, numbers of plug-ins have been created by several companies not only for music recording but to maintain the realistic sonic quality musical sounds. Different plug-ins that are commonly used in contemporary recording fields can be illustrated as follows:
1. AU - Apple units
2. Direct X - Microsoft’s Direct X instruments
3. RTAS - (For Pro-Tools) Digi design’s real time Audio- Suite
4. TDM - only for digi design Pro Tool systems
5. VSTi - Steinberg’s Visual Studio Technology Instruments

That particular computer plug-ins can be downloaded from internet or available on the market place as conventional CD formats.

4.5.2.3 MIDI Technology

The MIDI technology was developed in 1980s and proceeded to completely change and revolutionize the field of music recording and performing with its advanced features. MIDI or “Musical Instrument Digital Interface” is an electronically generated digital data communication protocol which is equipped to connect multiple devices such as synthesizers and musical instruments to communicate with each other. MIDI is completely a digital data communication protocol so that musical sounds are not transmitted through MIDI channels.

MIDI is an extremely flexible multi-channel electronic music environment which allows musicians to compose, edit and arrange their music compositions easily. Using the MIDI technology strings of data can be sent to a software or a device compatible with MIDI specifying; tone quality of a note, loudness, pitch, instrumentation, time duration, tempo etc. and such data signals can be played by a Key Board (MIDI compatible) or another software as a music composition. To communicate with other MIDI based equipments every MIDI based instruments and equipment have a specific five pin Input and output ports (the specific plug is commonly known as “male five pin DIN” (Deutsche
Industrie Norm plug). MIDI protocol specifies 16 separate channels. Therefore, by using one MIDI cable, one can manage 16 different instruments at once. Even though the MIDI stands for different functions, it is used commonly for Note on, System exclusive, and program change functions.

As far as the other instruments are concerned, electronic key board synthesizer has got a growing demand in the field of recording and music since the MIDI technology. Apart from that due to that technology, musician who is capable of playing a key board instrument can easily compose and record any music composition without depending on other musicians. In addition to that, only with a solo key board player one can handle any occasion very easily with a key board and pre-programmed MIDI files.

However, with the gradual development of technology, numbers of other MIDI operational instruments such as Wind controllers, MIDI Guitars have arrived for the mass market.

In advance to recording, editing and sequencing functionalities, MIDI can be employed to edit drum patterns, sample looping as well as music notation printing.

In the same way Compared to the other professional studios, people who have established home recording studios, mostly depend on the MIDI based key board for recording. Similarly, typical recording with different gadgets has been replaced by modern home recording environment equipped with MIDI technological tools.

On the other hand, so far as the procedures of composing and editing are concerned, MIDI has given vast avenues for artists Compared to the early practices of music composing. Similarly, the other advantage of MIDI is its small file size which makes it easy to store and other manipulation process.
4.5.2.4 Sampling Technology (Samplers)

Sampling is a modern technology which is used to create both distinct nuances of sounds of variety of instruments and other kinds of sounds for archiving them as sound libraries to use as pre-recorded samples for different kinds of recording purposes (This is an immeasurable area or field and it cannot be discuss as form of summarizing).

The equipment that is used for this purpose is commonly called “Sampler” and is capable of recording a sound, storing it on a specific medium. Thereafter, the recorded music pieces can be replayed and easily manipulated. In these sense cassette recorders, video recorders, and CDs can also be considered "Samplers".

Sampling technology can also be classified as analog and digital. Analogue sampling covers any method which does not use tape or digital methods to store the audio signals. In the modern world, the digital sampling technology has gained a considerable attraction due to the developments of the digital technology. For these purposes, devices such as analog to digital converters (ADC), Storing devices and digital to analog converters (DAC) are needed.

Nowadays, samplers are mainly used as the fundamental tools in popular music and in filming contexts. On the other hand, as per their applicability, those pre-recorded samplers are used by musicians for their recordings as row materials.

Most sample libraries come with their own sampler players and they require MIDI or audio input or output connections in order to be linked with the respective software (The “Sound Replacer” is a software plug-in of Pro tools which allows newly recorded drum sounds to be replaced with the previously sampled drum sounds).

Because of the technology of sampling, any sound can be stored and used as multiple purposes. When the global popular musical cultures, especially that of hip-hop music are
concerned, these technologies are used throughout the world\textsuperscript{67}. It can also be argued that there may be some occasions where the characteristics of certain compositions are seriously challenged by this technology. However, especially because of the practice of using pre-recorded samplers, it should also be stressed that there must be a global collaboration in order to cumulate new compositions.

As a result, of these sampler libraries, sound recording engineers and modern musicians do not have to depend on live recordings of renowned instrumentalists. However, the profession(s) of the instrumentalists are critically affected by the sampling technology.

On the other hand, using recorded samples as part of certain software for music compositions has made some indirect impact on the other musical traditions and international collaborations. Most patterns of samplers, were/are created by the world renowned artists who belong(ed) to different musical cultures. The contemporary software applications are equipped with such samples. Using them for music compositions has marked a new chapter in the history of both international and local musical cultures.

Samples are used for various purposes in addition to music recording. As far as the North Indian Classical musical tradition is concerned, the electronic \textit{Tabla} and \textit{Shruthi} are used as samplers not only for educational practices but also for accompaniments for concerts (only the \textit{Shruthi}). Furthermore, As a result, of the increased development of computer technology, samplers have been released as the features of software programs (even compatible with mobile phones) for the ease of artists and other related personalities. However, the existence of the traditional instruments has been challenged by these practices to a certain extent.
### 4.5.2.5 Generative Music Systems

The SSEYO Company has introduced the concept of Generative music to the modern computer world for the first time in the music industry. This technology incorporates composing music instantaneously via the KOAN software, a kind of generative music composition engine that allows users to define their own creativity to compose music with their own musical parameters such as key, scale, tempo and tones with samples. Accordingly, computer software generates music pieces based on these instructions and parameters. The result is the production of a generated piece of music which, when replayed on the generative system, is always similar in characteristics but never identically duplicate\(^6\). Since the downfall of SSEYO’s KOAN, a new company called Intermorphic has re-launched a finer version of the software under the name "Noatikl" in 2007\(^7\).

### 4.5.2.6 File Saving Formats

Besides the so called major advancements, the storing formats of manipulated data are also varied for those technological developments. In the magnetic tape era every signal was stored as an electric signal on the magnetic tape where as in the digital era some other developed formats were introduced according to the compatibility of on going technologies such as; AAC, AMR, AVI, MP2, MP3, MP4, M4A, M4R, MMF, WMA, OGG… etc. As its space saving capabilities and as far as Internet standards are concerned MP3 file format has been commonly utilized in modern days apart from the entire above file saving formats.
4.5.2.7 Development of ‘Home Recording’ Studios

While thinking for the current commercially based environmental situations, those new machineries with software provide user friendly atmosphere to those who are involved in the field. However, as far as the present situation is concerned, modern recording industry has become upside down since the DAWs and their accessories.

With the technological advancements there exist the small scale recording environments which are commonly known as home recording studios. Compared to old professional recording studios with huge recording consoles and other necessary accessories, it is easy to set up a Digital Work Station with reasonable budget. For the proper function of a DAW based recording environment, computers with minimum requirement of a Microphone (one or two), Audio recording interface or sound card(ARI), Software, Audio monitors and headphones are good enough.

The term “audio interface “was derived with regard to DAW based recording environments. Converting analog signal which comes from a microphone or a line in of a specific instrument to digital or binary numbers is the basic function of recording interface. This device can be connected to a computer via USB ports or Fire Wire connections. In addition to that, there are built-in pre-amplifiers to bust the weak signals. Professional audio recording interfaces exist in different shapes and sizes, performing different functions.

Adobe Audition, Audio Record Wizard, Cake Walk Pro Audio, Cubase, Cool Edit, Digital Performer, Logic pro 8, Nuendo, Pro Tools, and Sonar are some of DAWs which are commonly used in contemporary markets. Apart from the above names, some recordists use open source software such as Ardour, Audacity, harmony SAQ, Rakarrack…etc. for music recording and sound synthesizing. Basically, the layouts of these software are different from each other though their functional usage is unified.
Compared to the previous multi-track recorders, DAWs provide unlimited track counts for recording while some project based DAWs that has limited track counts. Using DAWs to which unlimited tracks re assigned, one can record more than one track for an instrument.

Aside from the Midi Keyboards, Head phones and sound monitors are used respectively to compose sounds and monitoring.

Due to the cost- effectiveness of the latest technology and, on the other hand decrease in price as well as advancement in performances, compelled people to establish software based own home recording studios. Consequently for many people this technological development has changed the location of production from the commercial recording studio to the computer based home set-up. Instead of traditional shape and the structures of studios and spaces, bed rooms, garages are utilized for recording. Such recording environments also change the large consoles and other out board devices while they use only one or two microphones, recording interface (sound card), computer with software and monitors and on some occasions very rarely a limited channel mixer (Such kinds of recording environments are very common among younger amateur generation ) resulted in the recording costs of professional studios. This technology has also affected the production costs of the studios. Alternatively construction of home recording studios which are equipped with inexpensive gadgets saves money rather than spending this money for expensive professional studios. Consequently, the artists and other related personalities normally tend to use inexpensive home recording studios. Instead of recording in the professional studios under experienced recording engineers, people who own home studios attempt to utilize the service of mixing engineers to mix down the tracks which were recorded in their own home recording studios. This is a new trend. As a result, some recording engineers devote their service only for the mixing purposes.
As far as the modern music software-based composing and editing practices and tools are concerned music recording has been developed as a “visual based sound editing art”. Similarly, due to the data manipulation processes and the patterns of editing musical data, the task of the contemporary musicians and recording engineers is almost similar to that of paints. Likewise, the music programmers have become musicians in this contemporary field of music by means of the technological advancements.

4.6 Development of other Related Technologies

Similar to the above stated technological developments, the other tools and devices which are related to the recording technology have also been transformed, modified and upgraded. For example, microphones which are sensitive to different frequencies of musical instruments are used and upgraded to suit modern innovative technologies.

As far as the microphones and their utilizations are concerned, a systematic application can be seen (which was absent in the earlier usages). The most important equipment in the recording chain is the microphone that works as a transducer to convert analog signals into electronic signals. There are three types of microphones in the market such as: Ribbon microphones, Condenser microphones and Dynamic microphones. Each one has its own characteristic qualities. However, there is a great demand for the condenser microphones in the field of recording and they are commonly used in audio recordings and in the field of music performances. However, the other types of microphones are also used to capture waves in the field due to their unique qualities. As far as the advancement in the field of recording is concerned, the pattern of the usage of microphones has been changed depending on the instruments, vocal ranges and the specific spaces and locations.

Similarly, a development can be seen in the microphone characteristics, directional responses and the microphone placement patterns to address various musical genres, and
instruments. Nowadays, the phantom power microphones are commonly used in the field of recording. These microphones designed to be powered directly from the consoles through the usage of phantom power supply instead of internal batteries\textsuperscript{76}.

In addition to this, an enormous development can be seen with regard to the devices such as instrumental pickups, microphone preamps, recording consoles, compressors, Noise gates, Equalizers, effect processors, head phone amplifies, and audio monitors which are located in sound recording studios\textsuperscript{77}. Modern acoustic architectural construction principles have also been applied in sound recording studios. Floors, walls, ceilings, windows and doors, noise isolation rooms and (cubicles) of studios have been constructed and shaped according to International standards capable of reducing noise.

4.6.1 Developed Genres of Music

As part of these developments, some music genres heavily depend on technology thereby influencing the musical cultures in the world in numerous ways. For example, Hip-hop, R&B, Dub-step, Electro, Techno and Re-mixing have been largely popularized as a new version of songs throughout the world. Popular versions of songs are selected to remixing without changing their melodies or lyrics (however, the Sri Lankan remixing culture is somewhat different from the world remixing tradition. It has been discussed in the seventh chapter of this thesis) consequently, a new position as a “remixing engineer” has been created in the world recording industry\textsuperscript{78}.

It must also be mentioned here that As a result, of these technological developments, anyone can easily become a "musician", or a sound recording engineer without much effort and expertise. This has both the positive and negative effects.
4.7 Internet: As an Advanced Tool of the field of Digital Recording and Distributing Music

Aside from the aforesaid technological advancements (analog and digital recording technologies) generally, the facility of Internet is a giant field in the age of digital era. Compared to the influential effects of previous technologies that led to the whole world, there is no other entity like Internet which has been influencing radically to entire world. It can be define as a form of a bridging technology. As far as its effects and influences to the entire world are concerned, we can see the rapid dissemination and diffusion in every field of every culture. It folds the entire world into a small space and brings global knowledge with in an instant of pressing a button on the key board of the computer or a mobile phone.

With reference to its influences only in the field of music, anyone can see how Internet has changed the listening practices, consumption patterns and other habits of music related works of people in different ways. As an advanced form of multi-faced communication tool, Internet figures out the approaches that music has produced, promoted, distributed as well as consumed. Similarly, those changes have caused to different types of piracies such as illegal downloading.

The influence of Internet as an advance tool to music can be discussed as follows.

1. As far as music recording is concerned: Internet facilitates variety of services such as; facility of Networking, providing DAW Software and plug-ins, Virtual instruments and Virtual space to compose (online studios). In music recording the facility of networking importantly affects in different ways. The most salient feature of networking is the mode of file sharing capability from one computer to another location and similarly, it broadens the storing capacity of space in different locations. Some web services on internet provide a platform to unknown musicians to work
together to come to an end of a music composition. The “Steinberg’s Rocket Networks” is one of the independent servers of that kind. This is also an online based software which allows to integrate with existing audio (multi-track/ MIDI sequencing soft wares) such as Steinberg’s Cubase VST and Emagic's Logic Audio. With the Rocket Net Server, musicians residing in geographically remote areas can work together on Internet to render service to each other for one composition or song. The time and space that associates with the music composition and the identity of the composition has also changed since with this practice.

Breaking conventional rules that pertaining to in-house studios; some musicians send their uncompleted music tracks to record world renowned instrumentalists via Internet. In such practices, a creation acquires a musical value as well as a multi-cultural value within the field.

Allocating virtual space for music recording and manipulation is one of the most prestigious advancement as well as a service which is provided by the Internet. Some World Wide Web services provide DAW (Digital Audio Workstations) based virtual recording environments such as www.soundation.com to any user for free of charge, such recording soft-wares provide plug-ins, MIDI synthesizers and samplers, real time effects with virtual instrument facilities. After completion the creative work they allocate a separate page to publish it with a waveform player. As far as the web based virtual studios are concerned, maintaining such space centered home recording studios would be unnecessary factor in near future.

2. As far as music performances are concerned: In this context Internet has destroyed the limitations of the world space and time boundaries in an interesting way. According to the traditional mode (but it is existing now a days also) artists must move to the specific locations whether nationally or internationally with their huge
stuffs to the performance. Even though with in the same locality if it would not be a problem.

3. As far as conventional methods are concerned: Internet has given a reasonable solution equipping via video conferencing technology. Accordingly, video conferencing technology could send both audio and video signals from a camera onstage of one city to another remote stage (locally or internationally) with connecting musicians or any other performers as a live performance with the proper interaction of audience\textsuperscript{81}. These kinds of Internet based remote performances are also known as “Telematic Performances” and these performances bring international and multiple locations together\textsuperscript{82}. However, to fulfill all efforts host agencies must have a net connection with higher bandwidth.

Similarly, there is a growing demand for using MIDI tracks and Karaoke tracks of original song compositions during some performances. Some web sites distribute MIDI based song tracks while Karaoke tracks can be downloaded from You Tube. In Sri Lanka, there is a growing demand for using MIDI tracks at home parties. 95% of young musicians most commonly depend on MIDI tacks with electronic key boards. While playing music in small scale social gathering ceremonies such as birth day parties, and wedding parties. Because of the demand for MIDI tracks, some key board music programmers have launched their own web sites to sole MIDI tracks via Internet. In view of that, the quality of so called music performances is in a higher stand. On the other hand miming to preprogrammed tracks, talent of handling instruments most probably becomes downward.

4. As far as music audiences are concerned: It provides or facilitates unlimited downloading facility for different audience as per their wishes. One of the most famous names of those kinds of sites is Napster which was specially designed for music sharing within peer to peer (P\textsubscript{2}P) groups\textsuperscript{83}. Some other commonly utilized
online file sharing software are “Shareaza P2P and Bit Torrents”\(^8\). Similarly, there are immeasurable web sites on Internet for downloading and file sharing. Some are; Rhapsody.com, E-music.com, i-tunes.com, Music match.com, Buy music.com…etc. \(^8\). However, some web servers do not allow the facility of downloading MP3 music files and functioning only as online music stores or archives. As one of the above kinds of web sites functioning only for Sri Lankan songs and music is Miyuru Gee (www.inforlanka.com) which is hosted by the inforlanka.

As an online listening platform “You Tube” is very popular among the world listening communities. Compared to the other online listening sites, You Tube isn’t a stereotype listing environment and that interactivity creates a center of attention not only to listening or watching modern visualized songs but also provides the “comment functionality” to give each one’s own views on respective musical or any related audio visual pieces. As a result, the viewer or browser is not only a listener but also s/he keeps her/his foot one step forward as an actively participated audience. The comments may be useful for artists in positive ways to fulfill their future creations also.

Compared to the conventional listening formats such as Vinyl, cassette tapes and CDs, web based audio communities have different benefits and options than conventional music listeners. Even though a CD has 16 to 20 songs, majority of them are not thoroughly appreciated. Still the person has to buy it for their appreciation but the web based user can only listen or download the song that s/he mostly prefers instead of buying the entire CD album of the artist. Correspondingly, s/he could listen different versions of the same song in different musical arrangements with different artists. In such options web based listener is more diverse than to other listeners while listening.

Apart from the above all facilities, You Tube brings world musical traditions including folk musical traditions as a method of conservation in addition to awareness of people about such traditions. As far as ethnographic, ethno-musicological and folk music
researchers and others who have a taste for music are concerned, the validity is really admirable.

Access to online radio listening via websites is also another significant feature of Internet. Some websites have brought all radio network channels, sometimes regional ones into one umbrella for easy access to listeners. Some online radio channels net-cast only music all 24 hours so that music lovers can listen to such radio channels according to their choices.

Similarly, You Tube makes a bridge to popularize un-popular artists among different audiences. As a result, even though such artists have not launched cassettes or CDs, they have been gaining a marketable value in the field and on the other hand becoming as much popular as well known singers. The marketable value of early mediums like cassettes and CDs has been decreasing since the You Tube. As a consequence there is a current trend of publishing new compositions (songs) of popular artists on You Tube as a new medium with visuals in Sri Lanka. Compared to the operating cost to release CD albums, artists can upload their creation to You Tube free of charge. On the other hand employing such strategies can be used to illuminate curiosity, they can also add good taste to their composition. Ultimately they can release CDs including those compositions and can build up proper demand in the market because of the popularity.

Similar to You Tube, the site named “MP3.com” is one of the biggest spaces which provide the facility of free downloading of diverse ranges of music. I also makes it possible for the artists to expose and disseminate their musical compositions among different audiences. The other salient feature of the MP3.com is the allocation of self-web page for artists to the information related to their career including the other information such as: description of their music, their influences, live performances, reviews, descriptions as well as allow them to upload pictures on the same page. Compared to
traditional cassettes mediums it is not possible to disseminate information especially related with the details of compositions and its influences in that way\textsuperscript{86}.

However, as a developing country, the facility of accessing internet has been narrowed down to a measurable population who are in sub-urban. On the other hand, computer literacy of the majority of people who are residing in rural areas in Sri Lanka is not fitting enough to utilize the technology of computer and Internet facility. They are yet experiencing music via radio lines and traditional mediums such as cassettes. But it is interesting to state here that since the growing demand to mobile phones, music that has been limited only to different web sites is being shared through mobile phones via blue tooth, infrared and other wireless technologies within peer groups.

5. As far as music as a business is concerned: Most companies and music related industries adapt to World Wide Web facility, since its convent usage and also as a contemporary mode of advertising. As per the convenient usage of consumers, those site holders maintain their virtual space as same as a physical music shop by displaying track lists with buying options also. Because of the special feature of track displaying, consumer has a possibility to listen sample tracks before consumption. The other important thing that is provided by such companies is the home delivering facility. However, the web based business is limited only to the people those who have technological access and the technological awareness.

As mentioned above, MP3.com is providing a precious service as a contemporary technology based mode of purchasing. Apart from that, if someone wants to purchase a CD of any artist, they provide the option for that too. Related CDs are manufactured and shipped by the company and the net profit is divided between the company and artist\textsuperscript{87}. 

\textsuperscript{86} It is interesting to note that during the early days of the internet, traditional mediums such as cassettes were still widely used, especially in developing countries like Sri Lanka.

\textsuperscript{87} MP3.com was one of the early pioneers in digital music distribution, offering a platform for artists to sell their music directly to consumers.

\textsuperscript{128}
According to the following quotation which was extracted from the PhD thesis of Dobie’s titled “The impact of the new technologies and the Internet on the Music Industry”

“……..The implication is that if a digital audio file can be electronically purchased and transmitted over a network, stored and played back on a compliant consumer electronics device, then distribution could change from a resource-, labor, and cost-intensive process of manufacturing and delivery of physical goods, to a more efficient and cost-effective system of electronic delivery on demand. This distribution model requires only one electronic copy of a song to be encoded from the master tape, to be stored on a company server and made available for streaming or download, bypassing the need for physical sound carriers (such as CDs and cassettes), as well as the entire costly industrial manufacturing process. It would eliminate the need to forecast sales figures in order to decide how many CDs to manufacture, and subsequently the wasteful over-production of a product which did not meet expected sales figures. If adopted outright, this model of electronic distribution and purchase would also render obsolete the process of transport and delivery from manufacturing plants to warehouses, and subsequently to retail outlets.

This system is potentially extremely efficient and cost-effective in comparison with the traditional manufacture-distribution-retail chain which claims 70% of CD retail prices, 21 leaving the remaining 30% to cover all other record company and artist costs, including personnel wages, production and promotion expenses, legal fees, membership of relevant institutions, and any other expenses incurred in the running of a record company….” 88
The idea what he has pointed out in the above quotation is a possible solution to reduce unwanted, unbearable costs during the production environments. But such kind of consuming formats and production environments are limited. The standard way of producing a cassette or a CD is thoroughly done by both parties (singer and the producer) with a regular bond and Finally, the distribution is handled by the company. After producing the master disc, the producing agent or the company handles the ownership of the album. In such a situation they never grant permission to sale albums in above ways that Dobie has mentioned. On the other hand, online web-based purchasing patterns are extremely novice to the majority of Sri Lankan community even in the 21st Century. Similarly, except some special audience, others do not buy music as an aesthetic commodity. Though very few companies already provide the service of online shopping to promote it to Sri Lankan community, the names of Torana Music Box, Maharaja can be quoted as such kind of leading music and audio-visual entertainment companies that provide online stores.

The advanced features of Internet technology affect as bad ways into the society as well as original artists. The main problem is the piracy based and related activities throughout the Internet. Internet is not the only medium that leads to piracy but traditional Cassettes have also lead to such illegal activities. In the research article “Sharing and Listening to Music” Extracting the quotation findings of Chesterman and Lipman’s work (1988) point out three types of pirated practices of music as follows:

1. Counterfeits are copies of music sold for profit in shops or markets passed off as original copies
2. Bootlegs are unauthorized releases of artists’ work such as recordings from live performance
3. Home taping

In these categories they especially point out how home taping operates as the most piratic movement among teenagers. But as far as the growing demand for Internet and web
based activities relating to music and performing arts are concerned, Internet piracy might increase when compared to home taping or home recording.

So far as the Sri Lankan Web based music sites are concerned, even though the authorities have taken measures to prevent music compositions from pirates, the strategy is not suitable at all for the meanings of those compositions compared to their music and lyrical contexts. While playing the song, the name of the Web Site is advertised as a jingle within the composition or song as per their choice. This practice is an extreme disturbance for an audience. Private broadcasting agencies in the country (Private media stations) initially introduced that practice, followed by the other music related parties and then it can be seen in use as a trend now.

As far as the modern technology is concerned, we can see that there is a growing tendency of performing art culture that associates modern technological tools more than previous ages to give a high quality aesthetic experience to various audiences. To accomplish such standards amateur younger generation sometimes change original compositions according to their choices and ambitions. As Mark Kartz points out:

“Downloaders can even go further and alter the very sound of their MP3 files. Various software programs, many available free on the Internet, allow users to change pitch or tempo, add or subtract musical layers, reverse sounds, tweak frequencies, and much more. In other words, listeners can become amateur sound engineers, even composers.”

Even though some people consider this practice as a good habit, once the involved people and manners in which they are created are critically considered, it becomes clear that these illegal modifications cannot be accepted on scholarly and ethical grounds. Even
though there is a copyright Act and a number of related regulations, there is no powerful mechanism to prevent illegal downloadings and modifications.

All in all, facilities such as emailing, chatting can also be used to communicate with different personalities in various contexts. Similarly, “Voice over Internet Protocol (VOIP) software applications such as Skype is used for different purposes”.

Employing “desktop sharing” feature, the P2P groups can share their desktops. This practice can also be applied for education and distance learning purposes effectively. This feature can also be utilized especially for music software learning, music editing (and also can be assist from remote area) and other related activities.

As a developed method, the online-based virtual spaces provide file saving locations as a methods of 'backing-up' data. This concept is technically known as “Cloud Computing”.

Google provides its “Google drive space” as a remote file saving space. It allows to store up to five GB data capacity in different file formats.

However, in spite of such occurrences, as an advanced form of technology the Internet has been providing vast majority of services as a modern bridging technology not only for music but also for music related other areas also.

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132
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