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Research Paper

Innovative business model of internet + with digital music production industry

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ABSTRACT

This research constructs a Cloud digital music production platform, illustrates the system operation process, and discusses its key technologies. Through the analysis of and comparison with current industrial conditions, this research proposes an innovative operation model for follow-up academic researchers and future industrial development. This research builds up an Internet + Digital music production system (I + DMP) through the Cloud technologies specific for digital music production. This research also describes the system operation process and explains each module of the system. Through the framework of I + DMP design and comparisons between Cloud and current industrial music production, the findings indicate that this innovative I + DMP operation model will create competitive advantages for the future development of music production. The systematic framework provided by this study provides a blueprint for the future direction of technology development and carries out a comparative analysis through the value chain and innovative operation mode to provide future industry cooperation and feasibility considerations. The present study describes the current status and problems in the digital music production industry and establishes a new industrial chain through the system framework of this research.

Key words: Internet +, digital music production, innovative operation model.

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INTRODUCTION

The finished musical products have been transformed from tapes and CD/MD in the past, into digital files such as MP3 and online stream music. Therefore, the production procedures and essential devices cost have had various changes. A lot of device suppliers converted their businesses from hardware development to digital software development. Meanwhile, the production mode has changed to a personnel working station. The quantity of music production has declined. People whose work is relevant to music production, including recording, producing, and musicians face the crisis of no profit. This is like the impact when digital MP3 was introduced in the mid 1990s. Eventually, music CDs became an accessory to marketing. Although music production has experienced the throes of digitalization, there will be a tempest of technological reformation again. Today, it may be an opportunity for the music production market which is affected by cloud computing service and confronts the internet and e-commerce.

For music production in the time of analog, a vast room and perfect devices were necessary. Music was saved on analog tapes, however, the parameters of all devices during the production could not be recorded accurately on the databank. Music producing staff or musicians had to stay at an immovable place or a studio that had the same compatible devices for recording. Music was pressed on CDs, and played on a CD player. Digital music production is springing up, and production staff can do most of the work on a computer/laptop equipped with a recording card even though there are many limitations. For example, the sample timbre database of arrangement is huge. The speed of data access for calling sounds is limited by hard drive efficiency, and computer's adjustment parameters cannot be recorded on database, or analyzed and value added can be applied. As off-site collaborative recording can be supported by some software, its practicability is affected by software compatibility, and the user's habit and culture. Production schedule may be pushed earlier by digitization, but it still cannot bring new models of music production operation and profit split. Due to digital music stream and piracy, the production is in decline and eventually people who work in this field will get less income. This study researches a new framework of internet + with digital music production to review the relation of the value chain and innovative model for converting the business rules and bringing new growing motivations.

LITERATURE REVIEW

Internet +

Today internet networks are a common information service platform. Internet networks started to develop in the 1980s. Now an enormous international network is connected via various networks and has become a global internet network of the world ("Internet," n.d.). The Internet has been the incubator for new network technologies, far surpassing the expectations of worldwide network suppliers. Two basic reasons underlie the Internet's success: the Internet satisfies the needs of its users and its technologies were developed by solving real problems (Weis, 2010). The emergence of the Internet has also had a huge impact on the relationship of the music industry supply chain (Swatman et al., 2006; Graham et al., 2004). Lu et al. (2003) also construct a TAM for wireless Internet indicating the change in the type of wireless mobile application development in the future and the differences.

In 2016, "Internet +"was proposed by Li Keqiang, the Premier of the State Council of the People's Republic of China who wanted internet network development of new forms and new industries in China. It shows that internet networks are mobilized and also is emphasized as a platform of integrating traditional industries with network applications, cloud computing, data analysis, and the value of knowledge. Internet +brings innovation and leads new trend developments. Furthermore, the new generation of information technology development implies that innovation of the knowledge society 2.0 is gradually becoming ready. The opportunity for economic transformation is now (Research 2016). Through internet networks, manufacturing industry can elevate its efficiency, quality, innovation, cooperation and marketing strength, information flow, and increase cash flow. Internet networks create more business opportunities (minor effect), and are able to change the relations of industrial value chain and industrial ecology, and relevant international technology development. Although most parts of digital music production have been digitalized, it is still at the beginning stage of exploring how to apply it to the internet network. Digital music production is similar to other traditional industries that will have a much more innovative development future. This study researches and analyzes how the internet network works on integration and innovation of digital music production.

Data process

Media streaming

Streaming is a technology (Jen et al., 2008) to compress a video file and send it to the client's buffer on the computer and to control video playing by time stamp (Liu, 2012; Lu, 2012; Tu 2010). Streaming is categorized into three groups: HTTP streaming (Berners-Lee et al., 1996; Contributors, 2014), RTSP streaming (Schulzrinne et al., 1998) and Clientless streaming by transport protocol (Tu, 2010). On Live and On Demand are the two main modes. In general, a video is transmitted online by RTP streaming (True Streaming's RTP transport protocol). RTP adopts UDP transport protocol to avoid sound or video delay (Liu, 2012; Schulzrinne et al., 2003; Goralski, 2009). Server modifies transmission speed and even effect load type via RTCP (Real-time Transport Control Protocol) and RTP provide flow and congestion controlled service (Goralski, 2009; Ott et al., 2010). Clientless Streaming adopts OTA (Over The Air) to deliver a Java player to the client side, to play the streaming files is more efficient on mobile devices and fulfil user's requirements for convenience and instant access (Lu, 2012; Tu, 2010). Online playing technology increases music's usability. Moreover, there may be problems that emanate from internet environment variations during actual data transits. First of all, the file is damaged due to transmission error - adding error control mechanism to compensate broken data. Second, bandwidth variation – to set up the extensible streaming file. Media server delivers the comparative smart streaming file with proper content to the client according to the bandwidth of user's device. The system maintenance staff only needs to maintain a single file, and the user can access any size or quality of media data under any bandwidth and device.

ASIO

ASIO (audio stream input output) is one of the standards of audio frequency API defined by Steinberg (a German company). Sound is recorded on the computer using a microphone or calling digital timbre for editing performance via MIDI controller. While tracking recording and playback are in process, audio frequency delay has to be decreased. Musicians cannot perform normally or control their emotions during recording if sound is delayed. VST (Virtual Studio Technology)/ VSTi (Virtual Studio Technology Instruments), plug-in programs –sound source and effector which are introduced by Steinberg, have been used most. ASIO (Audio Stream Input Output) is the major driver of these programs and provides very high quality of sound effect process with less delay. For the best effect of VST, the interface of sound effect has to support ASIO specification (Lo 2009). ASIO discards hardware centralized controlling by the operation system for reducing delay (the least time) and multi-tracks and multi-channels on audio frequency processing technology("Asio, Asio 4All, Ks, Was Api" 2011). Currently, delay time of MME driver (Windows) is 200 to 500 milliseconds, DirectSound is 50 to 100 ms, and Sound Manager (Mac OS) is 20 to 50 ms. Under ASIO, the buffer can be adjusted delay under 1 to 10 milliseconds according to different settings and the operation system so it brings just-in-time effect during recording and music production("ASIO," n.d.). Recently, timbre database is saved on the local hard disk, and it is called and loaded on the memory for controlling and using via VSTi software. If timbre database is saved in the cloud, it needs streaming to be downloaded on transient for monitoring.

The user uses a buffer supported by ASIO to access data, and controls timbre database and editing function in the cloud via music production APP. After computing is done in the cloud, the result is sent to the user by streaming. MIDI controlling and recording on the local are accomplished through ASIO agreement (Figure 1).

MIDI and MusicXML

The MIDI format is the technology most often used in computational music (Wan-jun, 2014; Viglianti, 2007). In 1981, Dave Smith, an engineer, first introduced the standard of MIDI (Musical Instrument Digital Interface). MIDI is a digital representation of music, used especially for communication between electronic musical instruments, including computers. The MIDI message associates an integer number to individual note (e.g. central C is 60), so it is suitable to a wide range of studies (Viglianti, 2007). The channel message is orders that are transited via any of the channels on the specific MIDI instrument (electronic instruments or electric instruments), which is including note's characteristics, expression's characteristics, and performance modes. The system message is orders that are transited via all channels on the MIDI instrument (Webster and Williams 2008) to control MIDI messages on all the instruments, which is including system reset and requirements of tuning. They are Exclusive Message, Common Message and Real-time Message (Lee, 2006), respectively.

A newer technology, MusicXML, offers the same possibilities and more, but requires different techniques for data retrieval. Music XML is a royalty-free format that implements all the features offered by XML technology: data structure / modularity / extensibility / possibility of querying and interaction through XML family technologies for conducting automatic analysis of music by adopting a statistical approach (Viglianti, 2007). MusicXML attempts to provide a common document type definition that is well designed from musical, human, and computer perspectives (Good, 2001).

By MusicXML, the interactive score is easily published on the internet, meanwhile, it is convenient for musicians who use different music software to exchange their information and collaborate (Wan-jun, 2014).

A large number of non-expressive data files in formats, such as MIDI and MusicXML (Good, 2001), are available on the Internet, and they are used by many musicians as a standard communication tool for ideas and pieces (Kirke and Miranda, 2009). Knowledge Discovery from Data (KDD) is entitled as some operations designed to get information from complicated data sets (Begoli and Horey, 2012). For digital music, data may comprise all the recording files and individual note of MIDI records (scales, strength, length, and channels) which truly record bars, instruments, notes of the music. They can be used as source for the training data and prediction and recommendation system data.

AUDIO to MIDI

During digital music production, direct audio recording is the majority section except performance input via MIDI controller. This kind on-structured multimedia audio file will not be able to be value added until the data is analyzed and converted. Every original sound of the music is a period signal which is composed by a single or multiple reference frequency sinusoidal waves. Each sound is an individual sinusoidal wave, and its function is:

$$s(t) = A\,sin(2\pi f t)$$

A indicates sound intensity which is a scale of waveform vibration. For example, there are stressed (strong) beats that magnitude is large and unstressed (weak) beats that magnitude is little in music bars. f is for identifying notes, called pitch or frequency, which indicates times of the same wave repeat and the repeat cycle. t is the time duration of a note according to the score requirement that refers to speed and beats:

$$T = \frac{1}{f}\ ,\ \ s(t+T) = s(t)$$

When Audio converts to MIDI signal, notes, pitch, beats, speed, the dynamics of Audio are converted and analyzed. Beats and speed are set at the beginning of the music production for obtaining digital information easily. About dynamics, it can be allocated to MIDI by equality of ratios according to the volume analysis.

1). Note: or Solmization. One time frequency between two notes is an octave. The seven keynotes of C major (C-D-E-F-G-A-B) are Do, Re, Mi, Fa, So, La and Si (numbers 1 to 7

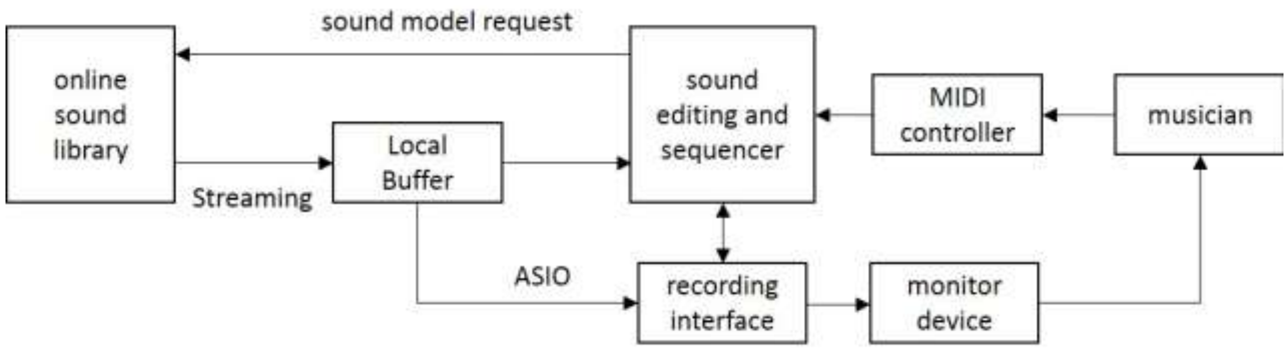

Figure 1: Applying mode of streaming and ASIO.

represent the notes of numbered musical notation). A standard tuning pitch 440 Hertz is A4, and A5 means an octave higher. There is possibility of infinite extent higher or lower. Digital marks of an octave begin from the note C and finish at the note B (C-D-E-F-G-A-B). For example: D4 is D upward C4, and B3 is B downward C4.

2). Pitch (frequency of notes): music is composed of all kinds of frequency of notes. In physics, vibration generates sound which is presented as the symbol f or vand Hertz (Hz) is the unit of frequency in the international system of units. In western music, an octave (ration 2:1) is divided into twelve particular frequency of notes also known as twelve-tone equal temperament (12 equal temperament). A mathematical relationship among the steady frequency, frequency of repetition:

For example:

$$f = \frac{71(times\ of\ repetition)}{15(time\ duration)} = 4.7Hz$$

A4 is the basic note and its standard pitch is 440 Hz. Numerical value of each note corresponds to the note symbol on MIDI after computing, and all of the notes can be represented as integer multiple of the Central A(A4). The distance marked as "n". A plus"n" indicates that a note is higher than A4, but on the contrary, a minus"n" indicates a note is lower than A4.

$$f = 2^{\frac{n}{12}} \times 440\ Hz$$

For example: a note "C5" is three and a half of notes (A4 → A♯4 → B4 → C5) away from A4, close to A4 and higher than C of A4, so its value of n is +3. The frequency of the note:

$$f = 2^{\frac{3}{12}} \times 440\ Hz \approx\ 523.25\ Hz$$

According to the formula, we learn that two notes differ from an octave or two octaves, the offset-frequency is integer multiple as well. Under twelve-tone equal temperament, "n" is absolutely 12-multiple (±12κκ, means a total of octave) and the formula second-order equation difference can be simplified to (Kirson and Lee, 1984):

$$f = 2^{\frac{\pm 12\kappa}{12}} \times 440\ Hz = 2^{\pm\kappa} \times 440\ Hz$$

Table 1 shows that the MIDI standard corresponds with the frequency and solmisation. Converted relation between MIDI note number ρ and f (frequency):

$$\rho = 69 + 12 \times log_2\left(\frac{f}{440}\right)$$

C4 is defined as MIDI note number 60, and to increase/decrease a number follows every upward/downward a semitone ("Pitch and Frequency Conversion Tables," n.d.).

3). Chord: a couple of notes are played at the same time during music recording. Each instrument plays different sounds and also the strength of harmonic. If comparison value of the frequency of two notes is very close to ratios of small whole numbers, these two notes play music harmoniously together. For example: the ratio of frequency of the two notes of 2:3 (440 Hz and 660 Hz respectively) is called perfect fifth. Because their harmonics are overlapping, the sound of two notes is harmonious which means the fundamental note should be the small whole numbers in mathematics language. Once the relation with ratios of every scale is comprehended, scale combinations of the sound will be decomposed to a single note that can be analyzed by the frequency ratio of chard ("Pitch and Frequency Conversion Tables," n.d.)(Table 2).

Sound is a period vibration, and the waveform determines timbre. To assume the waveform of a note on the piano is a sin, total 88 keys, the frequency of an individual note composes of a geometric sequence according to an equal temperament (12 equal temperament). Scale coefficient is (Kirson and Lee, 1984; "Frequency," n.d.; "Pitch and Frequency Conversion Tables," n.d.; "Why Keys Are Arranged in a Geometric Sequence," n.d.):

Table 1: MIDI standard corresponds with the frequency and solmisation.

Solmization	Frequency/Hz	Solmization	Frequency/Hz	Solmization	Frequency/Hz
C4	261.63	C5	523.25	C6	1046.5
D4	293.67	D5	587.33	D6	1174.66
E4	329.63	E5	659.25	E6	1318.51
F4	349.23	F5	698.46	F6	1396.92
G4	391.99	G5	783.99	G6	1567.98
A4	440	A5	880	A6	1760
B4	493.88	B5	987.76	B6	1975.52

Table 2: Frequency ratio of chard.

Scale difference(n)	Name	Approximate frequency ratio
0	Perfect unison	1:1
1	Minor second	16:15
2	Major second	9:8
3	Minor third	6:5
≀	≀	≀
10	Minor seventh	16:9
11	Major seventh	15:8
12	Perfect octave	2:1

Table 3: Geometric relationship with each single note.

Scale difference(n)	$2^{\frac{1}{12}}$	Approximate value of rational number	White key	Solmization
0	1		1	Do
1	1.05946			Do#
2	1.12246		2	Re
3	1.18920			Re#
4	1.25992		3	Mi
5	1.33484	1.333333	4	Fa
6	1.41421			Fa#
7	1.49831	1.5	5	So
8	1.5874			So#
9	1.68179		6	La
10	1.78180			La#
11	1.88775		7	Si

$$2^{\frac{1}{12}} = 1.059463$$

We can obtain a geometric relationship with each single note (Table 3). Multi-notes of the chord compose the waveform:

$$f(x) = sin(x) + sin(a^n x) + \cdots$$

For example: major third chord of C major is Do+Mi+So (1+3+5), and its waveform is as follows:

$$a = 1.05946$$
$$f(x) = sin(x) + sin(a^4 x) + sin(a^7 x)$$

Digital music production industry

The digital music production industry has been booming since the rise of digital music use. The structure of the digital music production today is shown in Figure 2.

Since tools for music production have been replaced by digital technology, the process and work distribution have not changed but there is a better possibility of speed, convenience, flexibility, variety and especially publication. Digital music products get into the market fast due to online e-commerce and audio streaming technology development.

In the current technological development and knowledge economy background, the structural evolution of the music

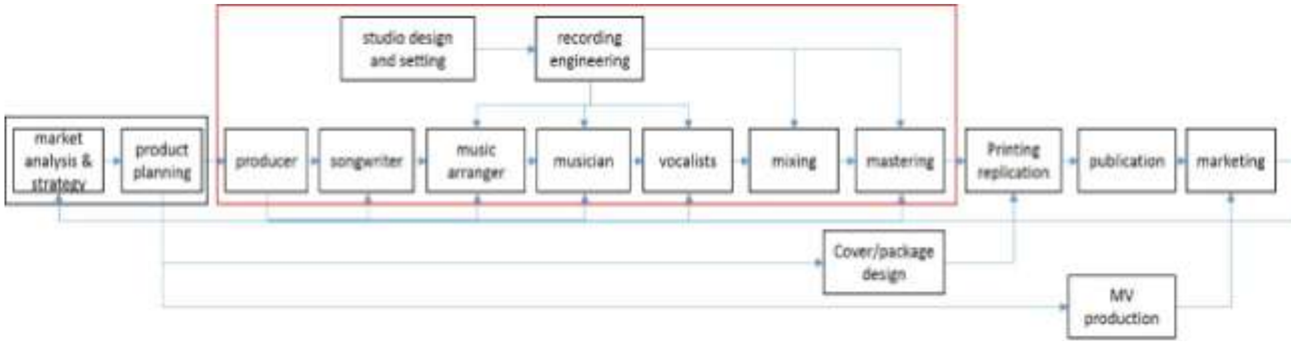

Figure 2: The structure of the digital music production.

industry will also have an impact on the relationship between the music production industry, especially the protection of copyright and the relationship between profits (Meisel and Sullivan, 2002; Preston and Rogers, 2011).

Digital sequencer

Arranger is the most important part of music production. With the advancement of technology, the software has more powerful functions. The arranger directly uses Instrument and Effect Plugins of the virtual sound module "Virtual Studio Technology Instrument" (VSTi) to process audio postproduction (Lo, 2009). By Musical structure planning and arrangement with MIDI controlling devices, multi tracking and transferring after arrangement which do not need to be transferred to the external tape devices, are completed on the computer. It reduces the sound attenuation during the conversion between digital analog signals. The real sound of the instrument or voice is recorded on the computer via the recording interface and then it is mixed together with music tracks which have be done by the virtual software to output as musical files. Speed of CPU, size of the memory, huge data storage space and fast access data are required of an arranger's working station.

With MIDI devices, all the notes become MIDI data which is recorded on the computer using DAW to compose and record. Meanwhile, there is close to no delay to play the performance by calling the timbre of virtual sound source which is driven through ASIO (Lo, 2009). Due to mobile devices being universal, music arrangement can be processed not only on the desktop working stations but also on the mobile devices. Many software companies (Steinberg, Image Line, and Apple) have developed various music production applications for mobile devices. Furthermore, there are applications for arrangement by artificial intelligence (A.I.) as the technologies of rote learning and artificial intelligence have matured in recent years (Braasch, 2011).

Digital arrangement has been substantially changed since mobile devices developed, software/sampling sound/effect plugins digitalization, controlling devices diversified, sound identification and editing elevated, and rote learning/A.I. utilized (Eck and Schmidhuber, 2002). Advantages of internet networks plus mobilization will be the next focus.

Digital audio engineering

Either matter arrangement or instruments/vocal recording needs to be processed by digital audio engineering which includes digital recording, digital mixing and the master process. DAW digital music production software covers most recording, editing and arranging functions so the engineer can control all kinds of functions, recording, adjusting, and adding different effect plugins. All the plug-in adjustment parameters can be presented as patterns through digitalization. Software companies offer many sample parameters for the recording engineers to use for adjustment at live recordings. After all the mixing of each song is completed for an album, it gets into the process of Mastering. The primary work of Mastering is for better sound performance and better quality of listening delivers the producer's or singer's original interpretation directly. Bob Ludwig, mastering post-production engineer from well-known Gateway Mastering Studio in the USA, says "Mastering is the technical and creative act of balancing, equalizing and enhancing, analogue or digital tapes so that the finished product will have attained the maximum musicality and competitiveness in the open market." Mastering engineers consider how to present the strength of sound and continue remixer's and singer's ideas of interpretation entirely. Mastering is the last step before publication, and the master file will be sent to star CD production or uploaded to the cloud for digital publication. The process of audio engineering and music production is shown in Figure 3.

I+DMP system framework

Since the internet technology and mobile smart devices have gained popularity and transmission speed has been

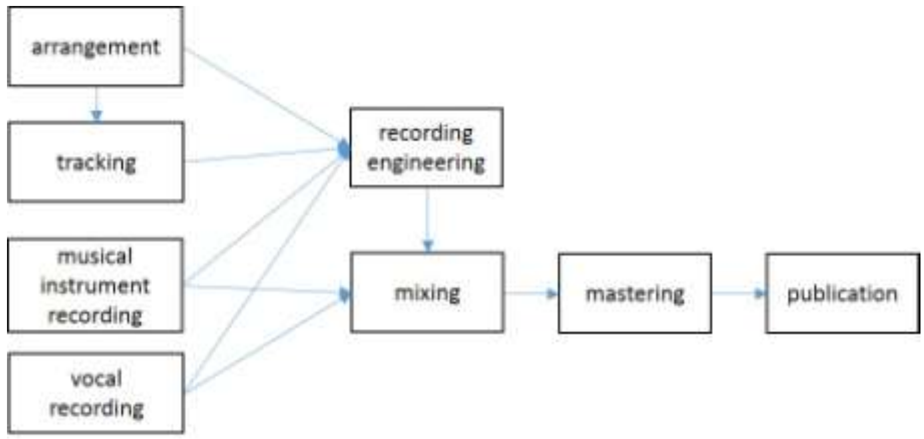

Figure 3: The process of audio engineering and music production.

developed well in recent years, the traditional industries are turning these advantages into opportunities. Innovative services in the cloud (020 e-commerce model) do not only transform the structure of industries but also makes the music industry face a new challenge. Users listen to online streaming music by downloading applications on mobile smart devices. People work for music production from different countries work together for a project via online collaboration. Lately, devices for music production can be controlled by a computer and the recording files are saved on it. After mastering, music can be published and sold on cloud music publication streaming platforms. Explanations of I+DMP system framework (Figure 4) are:

1). Musicians create original music in different ways which include recording by sound recorders, performing or inputting notes by MIDI controllers, inputting instrument performing signals by mobile instrument performing applications.
2). When music is recorded in the environment without any proper soundproofing equipment, noise will be recorded as well. It has to be eliminated from the recording signals. MIDI controller or the applications of musical instruments call on other sound source software to send MIDI signals to applications of mobile music production for the next step.
3). After noise is removed from live recording files, they can be saved on the local hardware. Files are uploaded to the cloud for collaborative editing and analyzing.
4). Upload recording files and MIDI content to the editing platforms in the cloud synchronously for the coming editing.
5). When calling digital sound sources or other recorded sound tracks for collaborative work, they are downloaded to Media Buffer (the local side) for computing synchronously.
6). After sound is integrated synchronously, it is sent to the applications of mobile music production for live performing and monitoring.
7). Recorded files and monitored sound are sent to the music production staff with low delay efficacy through ASIO transmission technology.
8). Music production staffs in different locations are able to work together in the cloud for music production and editing by the same methods and the applications of mobile music production. For example: instrument performing or remixing.
9). Recorded sound, edited MIDI files and the parameters of effect plugins adjustment can be saved on the database in the cloud. The database also provides online sound sources and timbre for editing and selections of effect plugins.
10). Unite all tracks (sound files, MIDI calling sound source, and effect plugins) to be computed jointly and then upload the files to music editing platforms in the cloud.
11). Music editing platforms in the cloud send the musical files to the staff by online stream. The staffs are able to preview the production content rapidly without downloading the files anywhere. Quality of streamed musical files is made by the conditions of internet transmission. High quality of files can be downloaded as well.
12). On database in the cloud, recorded sound files and MIDI files are converted to MusicXML files for data analysis sequentially.
13). Online shops offer the music production staff selections of free or paid online sound source software and online effect plugins to use.
14). Before the files are recommended to the music production staff, the content is categorized and correlation analysis with rote learning of MusicXML language. Arrangers can not only purchase the content they need but also they can upload their works which will be added in the recommendable system. Besides, parameters of recording and remixing recorded and analyzed in the cloud are also on the recommended list for the related staff to buy.
15). Online shops sell recommended music production works that brings revenue from intellectual property to the staff.
16). Music editing platforms in the cloud offer product

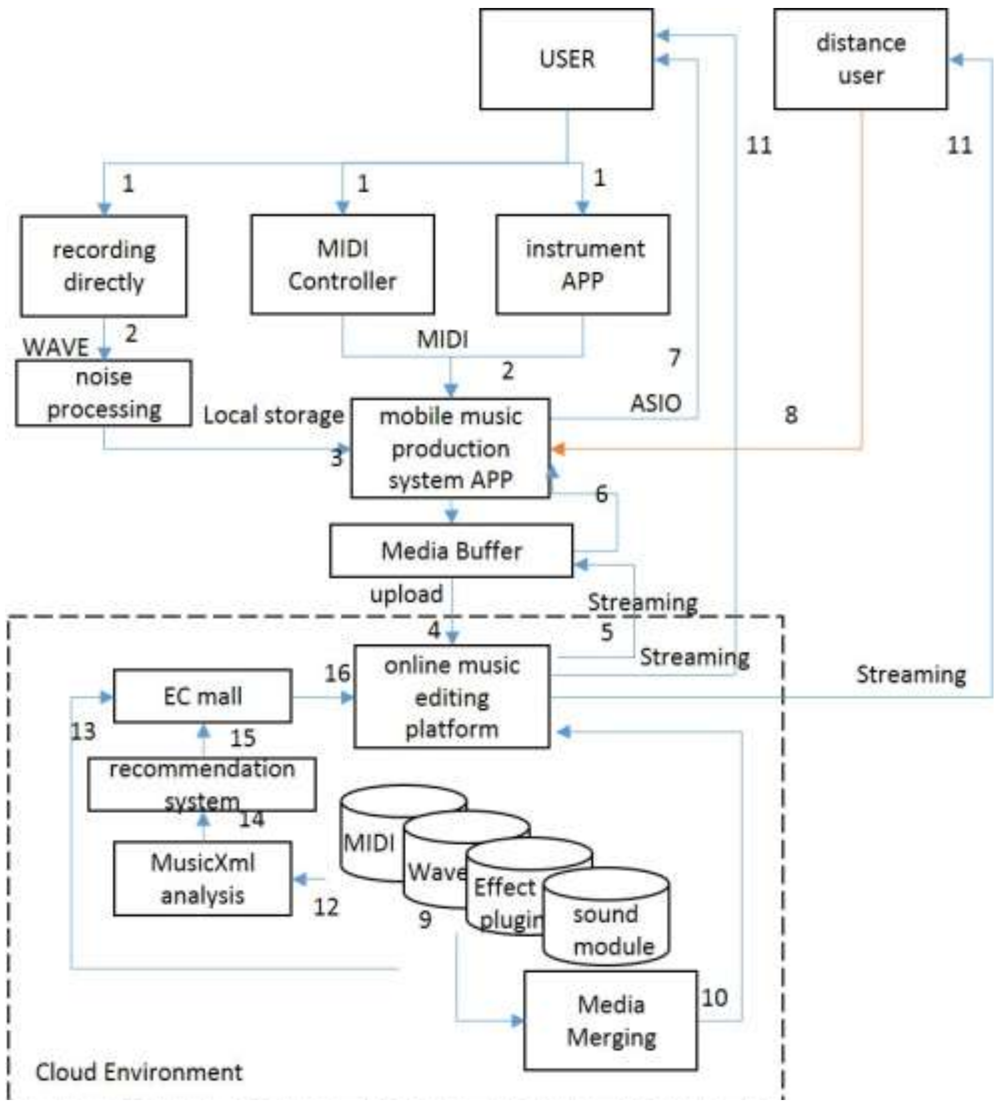

Figure 4: I+DMP system framework.

recommendations and shopping, more than editing functions. The finished music works can be published and sold directly by online shops. Division of labor is recorded clearly on the system benefits to set up an innovative and more reasonable profit sharing model. It improves unfair profit sharing from the past and the structure of industrial value chains and establishes a new cooperation model.

Analysis of the system module

The system module of the study includes: application interface in the cloud, editing module, business module, sorts of MIDI and WAVE database, sound source and timbre database, recording/remixing effect plugins parameters database, data analyzed and recommended module, online shops module and finance module. Explanations of Figure 5 are as following:

1). Record MIDI files are produced by arrangement, and MIDI and MusicXML database module which are converted from WAVE files of live sound recording.
2). Arrangers call timbre from all kinds of sound sources and timbre database in the cloud through the arranging interface for the follow up arrangement.(ex. piano timbre, jazz drum timbre, special effect timbre).
3). After mastering, WAVE database which are produced from live recording and MIDI arrangement calls timbre became WAVE database module.
4). Record the parameters of each track on the effect plugins during recording and remixing. For example: compressor adjustment's parameters of an electric guitar, EQ's parameters of a piano.
5). Analyze structured MIDI data, convert non-structured sound data, and provide recommended information modules to the music production staff by rote learning and data analysis algorithms.

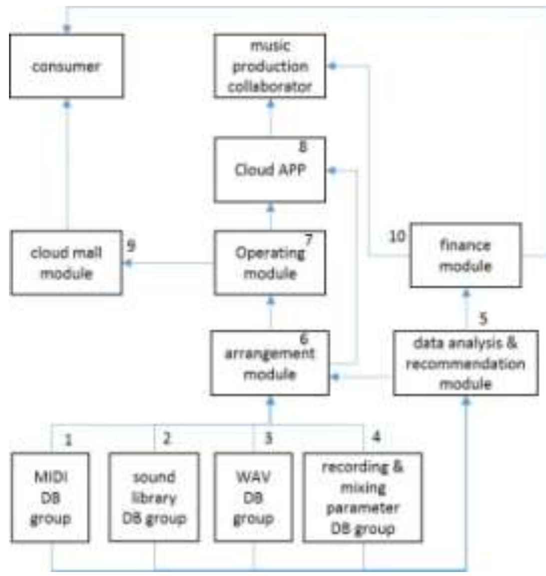

Figure 5: I+DMP system module analysis.

6). Provide editing functions for arrangement which are multi-tracks editing, MIDI data editing, sound module usage and editing, recorded files editing, and all types of effect plugin usage and editing. Furthermore, arrangement modules recommend the information which is analyzed to the staff for more options. For example: piano performing, chord designing, and parameter adjustment of the effect plugins.

7). Music production staff purchases packages of music production according for their needs on the online commercial system. For example: sound source packages, effect plugins packages, and the packages are recommended by instantaneity analysis

8). Music production staff only needs internet to produce and edit music on the platforms in the cloud, and therefore they can work collaboratively anywhere. Applications on the local mainly control cloud computing to reduce computing workload on the local. The staff can use the space in the cloud instead of a mass space for saving music source and decrease waiting time for download. As the characteristics of mobilization and smart devices, music production will be more diversified.

9). When music is published online, customers can purchase or subscribe to it by streaming.

10). Finance module includes the financial control system of the music production staff and customers. The staff buys timbre software or effect plugins from the platform providers or software developers. The contents of music production (MIDI, WAVE, or parameters) are recorded on database in the cloud and can be sold to people if needed via data analysis and recommendations. Revenue from customers' buying or subscribing will be divided base on the staff's contribution to set up a new profit sharing model. It may attract more people to be willing to get involved with music production.

ANALYSIS AND COMPARISON

Value Chain analysis

The concept of "Value Chain" is from "Value Chain Analysis" (Primary Activity and Support Activity) presented by Michael Porter (Porter, 1998). Kogut Bruce mentioned that the value chain equals a series of activities of product's market value (Kogut, 1985). In addition, Porter also claimed that a series of value chains is the value system, upstream/midstream/downstream suppliers, enterprises, channel distributors, and customers are involved (Liu, 2009). If the industry plans to develop its advantages, it has to find out the advantages from its value system and need capacities for integrating the value chain system.

Since the music production industry is affected by digitalization, the business operation mode has been transformed from CD selling to live performing and endorsed advertising. However, relations between the value inventors of the industry do not have too many variations. This study proposes that under ideas of the structure of I+DMP a model is set up by the value of every contributor. A relational structure with upstream/downstream companies of the digital music production is shown in Figure 6.

According to the recent digital music production industry, this study analyzes and compares the essence of the value of each affiliated staff. Upstream: record companies, audio companies, and platform providers in the cloud. Midstream: music production staff and audio engineers. Downstream: distributors and buyers (Table 4).

Innovative operation model

A study by Mitchell et al. (2003) shows that outstanding

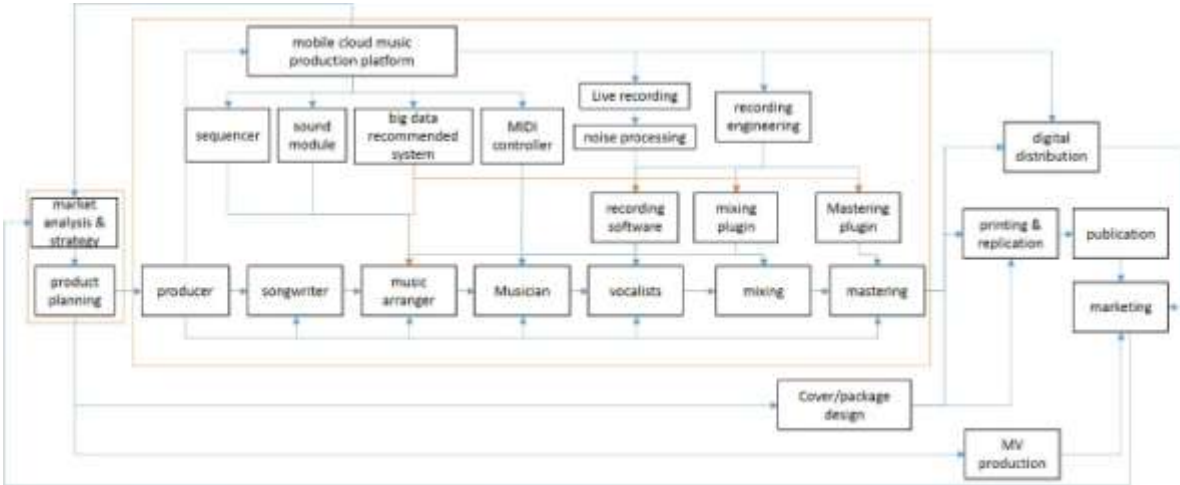

Figure 6: Companies relationship structure in I+DMP system framework.

Table 4: Analysis and comparison of each staff role value.

Industrial relation	Unit	Staff role	Key points of value Assessment	Advantages	
				Under the current Industry	Under the study structure
Upstream	Record Company	Market Analysis	Actual market contact and perception	High	Medium
			Channel and sales information	High	High
			Online digital operation platform	Listen Habit Playlist	Listen Habit Playlist Production Analysis
		Product Planning	Personal subjective experience	High	High
			Originality integration ability	High	High
			Design ability	High	High
		Marketing	Exposure opportunity integration	High	High
			Endorsement sales ability	High	High
		Financial Management	Profit generation	Low	High
			Profit share elasticity	Low	High
	Audio Company	Studio Planning	Equipment and planning ability	High	Low
			Space and soundproof ability	High	Low
			Finance ability	High	Low
		Software and Hardware Development	Digitalization	High	High
			In the cloud	Low	High
			Modularization	Medium	High
			Standardization	Low	High
	Platform Company in the Cloud	Service Planning	Quality of file/transmission	Medium	High
			Online system computing ability	Medium	High
			Mobilization application	Medium	High
			Operation system support	High	High
			UI function	Medium	High
			Online networks and sharing	Medium	High
			Multiple purchase mode	Trial and Subscription	High
			Member database analysis	Listen and Subscription Record	High Utilization

Table 4: Continued.

			Business module	Subscription only	Diversity
			Music production collaboration module	NA	High
			Music production database analysis	NA	High
			Module platform integration ability	NA	High
			Application development elasticity	NA	High
			Platform implementation cost	Medium	High
Midstream	Music Production Staff	Producer	Musical knowledge learning	High	Medium
			Musical style production experience	High	Medium
			Music originality integration ability	High	High
			Staff communication ability	High	High
			Project management ability	High	Medium
			Musical market perception ability	High	High
		Songwriter	Life observation ability	High	High
			Perceptual emotion	High	High
			Music acuity and sensitivity	High	High
			Literary ability	High	High
			Creative imagination ability	High	Medium
		Music Arranger	Music theory ability	High	Medium
			Performance ability	Medium	Low
			Musical instrument characteristic proficiency	High	High
			Well utilization of arranging software and digital timbre	High	High
			Timbre database quantity	High	Low
			Concept of music composing ability	High	High
		Musician	Reading musical notation ability	High	High
			Performance ability	High	Medium
			Music theory ability	High	High
			Improvisation ability	High	High
			Musician cooperation ability	High	Medium
		Backing Vocalist and Singer	Timbre, hearing, intonation, expression controlling	High	High
			Backing vocalist's hearing ability	High	High
			Sound techniques ability	High	High
	Audio Engineer	Engineer	Software/hardware familiarity and operation ability	High	High
			Types of sound controlling and adjustment ability	High	High
			Supreme software and hardware	High	Low
			Concept of music space and frequency	High	High
			Sharp listening ability	High	High
Down-stream	Distributor	Publication Channel	Physical channel distribution	High	Low
			Virtual channel on-shelf	High	High
			Reasonable and convenient payment method	High	High
		Sales Channel	Online marketing applying	Medium	High
			Media channel	High	Medium

Table 4: Continued.

			Digital platform broadcasting exposure ability	High	High
			Marketing activity ability	High	High
	Consumer	Customer: Music	Consuming ability	Low	Medium
			Community influence	Medium	High
			Music and idol preference	High	High
		Customer: Music Production Staff	Consuming ability	Low	Medium
			Community influence ability	Medium	High
			Equipment's brand preference and proficiency	Medium	Low

Table 5: Compares use business model elements.

Four pillars	Nine building blocks	Digital Music Production	I+DMP	Remark
Products	Value Points	.Equipment digitalization and software .Upgrade hardware quality .Product's full ownership	.Software and mobilization products .Using the product and service with fundamental equipment .Purchase product module if needed .Revenues from the musical staff's intellectual properties	Propose overall concepts of the product and service to the enterprises
Clients	Target Customers	.Professional musical staff .Investment by enterprises (ex. studio, production company)	.Professional musical staff .Non-professional musical staff .Enterprises and service developers	Describe the target customers of the Sales Price
	Distribution Channel	.Online shopping .Agents .International business channels	.Online download or purchase .Agents .International business channels	Describe methods of contact between the enterprises and variety groups of customers
	Relationship	.One-time purchase .After service and guarantee .Plug-in expansion module .Purchase mode .Educational training service .Technology licensing .Agency/distribution	.Relationship of musical work collaboration without borders .Relationship of music products and other music pieces .Software in the cloud maintenance .Plug-in expansion module purchase mode .Online teaching .Technology delegation .Relationship of the application developers and platforms	Explain the types of connection between the enterprises and variety groups of customer
Fundamental Management	Value Types	.Quality of the equipment .Users' technology skill .Personal learning experience	.Unlimited time and space .Machine learning intelligence with added value .Distributed computing mode in the cloud .Public's intelligence offers value .Fast, Convenient, Collaboration and re-added value	Describe activities and resource arrangement

Table 4: Continued.

	Core Abilities	.Quality of the equipment for sound process .Computer's implement ability and hardware space .Processor's computing and postproduction ability .Physical space and audio technology .Operation and integration ability	.Application developments on the platforms .Computing processor in the cloud .Data space and management in the cloud .Analysis of data mining and intelligence algorithm and recommendations .Business mechanism of shops in the cloud .Profit sharing and finance mechanism	Necessary abilities of executing the business models
	Partners	.Software/Hardware technology providers .Confined music production staff .Record companies and platform providers	.Software/Hardware developers .Global music production staff connection .Providers of platform in the cloud	Be able to propose effective cooperation agreement internet with other enterprises
Finance	Costs	.Software .Hardware .Upgrade and renew software/hardware .Interior design .Staff and musicians .Maintenance	.Purchase package software .Purchase hardware .Purchase recommended production products .Groups of music production staff .Setting up a platform and maintenance	Overall business models by financial results
	Revenues	.Physical CD sales income .Online music sales income .Online membership fee income .Vocalist and copyright of songwriting income .Advertisement on the platform income .Staff's one-time income	.Physical CD sales income .Online music sales income .Online membership fee income .Unlimited vocalist and copyright of songwriting income .Staff's profit share income .Staff's intellectual property income .Advertisement on the platform income	Describe the revenue sources and methods of profit

performance enterprises keep reviewing and updating their business models to adapt themselves to the market. Industry's business models do not only show the business logics of an enterprise but also imply its possibilities in the future. A study by Osterwalder and Yves (2005) also complied with the common combinations of the business models to compare and research into their elements. They introduced the elements, four pillars and nine building blocks constitute a business model (Osterwalder and Yves, 2005, 2004). Moreover, "A business model is a conceptual tool, including its definition, type of element, attributes and relationships to other elements, and business logics of an enterprise. An enterprise brings the value to more than one groups of customer, statement of the business structure, creation, marketing, delivering value, partnership network, profits, and in line with revenue (Bai, 2007).

Researching into the business model supports to define participant, role, responsibility, market size, business target, core competitiveness, relationship module, revenue module, value exchange map, key factors of success (Pateli and Giaglis, 2005). It assists the management to obtain, understand, communicate, design, analyze, and the concept tool for altering their "business logic" (Bai, 2007). This study states and compares the digital music production industry and I+DMP industry base on four pillars and nine building blocks (Table 5).

Conclusion

The present study researches into the systematic statement and analysis of developments and possibilities of I+DMP industry; meanwhile, the technology in the cloud and mobile internet build up the industrial chain's structure for the industrial developers and music production staff to think about the future strategies. Concerning the industry's problems at present, the concrete and possible solutions are proposed by the study hopefully provide the basis of strategies for the future digital music production industry development. Furthermore, studying internet, big data analysis, machine learning, collaboration in the cloud, cloud computing, and mobile application outline a brand new I+DMP industry. It does not only take advantages of convenient and innovation of information technology but suggest solutions for improving the ingrained old profit sharing issues. Following the emergence of digital music service platforms, there is the need to re-create the value of music production staff's intellectual property instead of one-time purchases.

Regarding developments of musical equipment, crossing-over the systems and meeting the standards in the cloud that will be new challenges and capital investment should be considered. The system framework proposed by the study needs more software companies and equipment suppliers to get involved so that the value contributors could be shifted to the system sooner.

The value chain is a completed value system connecting the upstream, midstream and downstream, and its operation model cannot be affected by just a single unit. It is no doubt that the improving internet technology, data smart learning, more accurate analyzes, convenient equipment, and computing ability promotion are the challenges but also opportunities for the digital music production industry. After observing that internet technology in the cloud affects other industries and brings changes and innovative operation models, it is not hard to foresee that the digital music production industry is going to confront the same kind of revolution as well.

Today the digital music production industry is in a challenging new situation. The industrial structure and system framework of the study do not apply to the new technological system at all, but they integrate systems and technical development trends to propose an innovative operation model. Consequently, we may not know whan technical issues will occur. In addition, the music production staff from different countries with different using habits, industrial culture, and learning motivation cannot be said to know how soon the system will get into the market, nevertheless, they can be the objects for the future study. The innovative operation model of I+DMP will absolutely be an important trend of the industrial developments in the future.

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