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# TOOLS OF THE TRADE: DIGITAL AUDIO WORKSTATION USAGE ANTECEDENTS

# ALATI OD ZANATA: ČIMBENICI KORIŠTENJA DIGITALNIH AUDIO RADNIH STANICA

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*Abstract*
Recent advances in music technologies have unleashed a phenomenon in digital audio workstation (DAW) utilization among artists for the tasks of composing, recording, mixing and mastering music. Artists had a significant impact on the development and adoption of new recording technologies, expecially with music industry changes in the the last decade. Persson states that home recording equipment and DAWs created competition for commercial studios, and caused a re-evaluation of the production process and what is recorded at home versus in the commercial studio and by whom. The focus of this research is the individual experience among heavy metal and hard rock artists with DAW utilization in the process of composition, pre-production, recording, mixing and mastering music. A better insight into the factors influencing the digital audio workstation usage enable DAW providers to align the DAW functions and capabilities to meet the artists' needs. This study combined the Task-Technology Fit model with the Technology acceptance model, which specifies the causal relationships between perceived usefulness, perceived ease of use and usage behavior. With 838 completed surveys, a partial least squares structural equation modeling approach was used for the assessment of the measurement and structural model.

*Sažetak*
Razvoj informacijskih tehnologija u glazbenim djelatnostima omogućio je korištenje digitalnih audio radnih stanica od strane glazbenika za potrebe skladanja, snimanja i produciranja glazbenih sadržaja. Glazbeni umjetnici imali su značajan utjecaj na razvoj i usvajanje novih tehnologija snimanja glazbe, posebice u kontekstu promjena u glazbenim djelatnostima u posljednjih desetak godina. Persson navodi kako su oprema za kućno snimanje glazbe i digitalne audio radne stanice stvorile konkurenciju komercijalnim studijima te uzrokovale reevaluaciju procesa produkcije glazbenih sadržaja, posebno u smislu mjesta snimanja i samog snimatelja. Fokus ovog istraživanja je osobno iskustvo izvođača heavy metal i hard rock glazbe u korištenju digitalnih audio radnih stanica u procesu skladanja, pred-produkcije, snimanja i produciranja glazbenih sadržaja. Jasniji uvid u čimbenike koji utječu na korištenje digitalnih audio radnih stanica omogućuju programerima digitalnih audio radnih stanica usklađivanje funkcija i sposobnosti istih, sa svrhom ispunjavanja zahtjeva korisnika. Ovim istraživanjem objedinjeni su model pristajanja zadataka i tehnologije i model korištenja tehnologije, koji navodi uzročnu vezu između percepcije korisnosti, percipirane jednostavnosti korištenja i ponašanja pri korištenju tehnologije. Na temelju 838 prikupljenih anketa, ocjenjen je mjerni i strukturni model modeliranjem strukturnih jednadžbi metodom parcijalnih najmanjih kvadrata.

## 1. INTRODUCTION

Technological innovations have always influenced the ways in which music is made and consumed in societies /**1**/. Hughes & Lang identified an emerging trend in music production; scarce, expensive production resources (traditional recording studios, CD presses) are being replaced by ubiquitous, low-cost production resources (Digital audio workstations, MP3 storage media and IT storage media in general). A computer-based digital audio workstation (DAW) is an electronic system which comprises four basic components (computer, audio interface, digital audio editor software, input device), designed for recording, editing and playing back digital audio. Persson /**2**/ states that a DAW includes computers, interfaces, external mixers, soundcards, and software (controls, mixers and additional features) with the addition of other external digital equipment such as reverbs, equalizers and plug-ins (effects). A DAW allows recording, editing and mixing audio through visual interfaces entirely in digital form, providing the highest sound quality. Advances in music technologies led to a growing diffusion of DAW utilization among artists. For this research, the DAW usage antecedents among heavy metal and hard rock artists are explored. The results can provide researchers and DAW developers better understanding of why and how DAW characteristics and their fit with task characteristics drive DAW utilization by end-users for particular tasks (composition, pre-production, recording, mixing and mastering music).

## 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

With all computer software, the efficiency of the workflow depends on the design methodology, which impacts the level of interaction required for optimum operation whether this is for the pro user or the consumer. This interaction is mediated by the graphic user interface (GUI) the best of which have been designed using principles of human computer interaction - HCI /**3**/. DAW software, specifically it's implementation design, allows for easier building and debugging, but sometimes it ignores the needs, desires and mindsets of the end users and their workflow. Created to fit within workflows steeped in analog processes, DAWs logically emulate the look, feel, and functionality of the hardware they are designed to replace (Koda, 2011). Koda (2011) states that the active design choice to mirror hardware-based methodologies limits the actualization of DAW software's full potential, and the advancement of new methodologies and workflows for audio, as follows: (1) Emulating hardware layouts also emulates their flaws, (2) Emulating hardware technologies ignores possibilities with digital technologies and (3) Emulating obsolete hardware layouts creates a barrier to new entrants into the field. Current Digital Audio Workstations include increasingly complex visual interfaces which have been criticised for focusing user's attention on visual rather than aural modalities /**4**/. Mycroft & Reiss suggest that cognitive and perceptual factors of GUIs may contribute to the optimal use of DAWs. Koda /**5**/ points that metrics considered important by sound editors and designers have been largely marginalized; things like intuitive manipulation, transparency, ease and enjoyment of use, and scalability of tasks. Many researchers studied the application of DAWs for music production (Leider 2004; Koemans & Collins, 2004; Hosken, 2010; Savage, 2011; Koda, 2011) but none of them analyzed DAW usage antecedents. Nance & Straub /**6**/ state that information technology usage is regarded as a core variable in IS research. The Technology acceptance model /**7**/ has been widely used to test the acceptance of information technologies. According to Davis, perceived usefulness and perceived ease of use are important factors that influence the attitude of individuals toward a particular technology. The TAM states that perceived ease of use and perceived usefulness have a direct effect on the attitude toward the use of a technology along with perceived ease of use having a positive effect on perceived usefulness. Research on TAM and other behavioral models of antecedents to system usage suggests that individuals tend to make IT usage choices based on their perceptions of system usefulness /**8**/. Task-technology fit (TTF) is the degree to which a technology assists an individual in performing his or her protfolio of tasks /**9**/. The antecedents of TTF are the interactions between task, technology and individual. Goodhue & Thompson argue that as tasks become more demanding or technologies offer less functionality, TTF will decrease. They mapped the TTF components as follows: (1) data quality, (2) localibility of data, (3) authorization to access data, (4) data compatibility between systems, (5) training and ease of use, (6) production timeliness, (7) system reliability and (8) IS relationship with users.

Utilization is the behaviour of employing the technology in completing tasks. Even though the utilization construct is not well understood, Davis et al. and Goodhue & Thompson propose measures such as the frequency of use or the diversity of applications employed. The impact of TTF on utilization is mediated by the beliefs about the consequences of using a sustem. Goodhue & Thompson indicate that TTF should be an important determinant of whether systems are believed to be more useful, more important, or give more relative advantage.

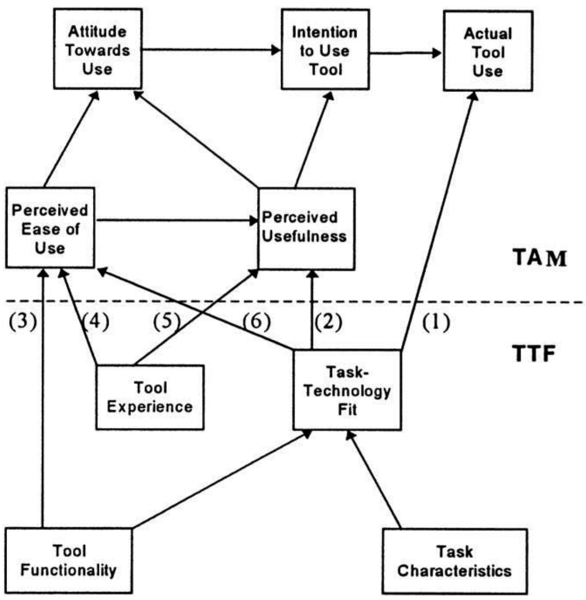


**Fig.1.** Integrated TAM/TTF model (Source: Dishaw & Strong, 1999)

Dishaw & Strong /**10**/ extended TAM with TTF constructs. Their results indicate a better explanation for the variance in IT utilization than either TAM or TTF models alone. In their integrated TAM/TTF model (Figure 1.), TTF constructs directly affect IT utilization and indirectly affect IT utilization through TAM's primary explanatory variables, perceived usefulness and perceived ease of use.

Based on Dishaw & Strong's integrated TAM/TTF model, the following research hypotheses are proposed:

**H1.** User evaluations of TTF will be affected by both task characteristics and characteristics of the technology.

**H2.** Perceived ease of use will be influenced by the TTF, technology characteristics and individual experience with technology.

**H3.** Perceived usefulness will be influenced by the perceived ease of use, TTF and individual experience with technology.

**H4.** Attitude towards use will be influenced by both Perceived usefulness and Perceived ease of use.

**H5.** Intentions to use the system will be influenced by both Perceived usefulness and Attitude towards use.

**H6a.** Usage will be affected by the intentions to use the system.

**H6b.** Usage will be affected by the Task-Technology Fit.

**H6c.** Usage will be affected by task characteristics.

## 3. RESEARCH METHOD AND RESULT ANALYSIS

### *3.1. Data collection procedures and data analysis*

For the purpose of this research an online survey was used. Hard rock and Heavy metal bands were contacted through e-mails provided by the independent management and promotion agency Full Metal Service. The data was collected from February to March 2014. A total of 838 valid surveys from band representatives from all around the world was analyzed for demographics and other descriptive statistics, including respondents' experience with DAW, the most frequent tasks they use the DAW for, and the DAW software of their choice (Table 1.). 88% of the respondents's age is between 20 and 40, most respondents are from European countries, only 11% of the respondents have less than 1 year experience using a DAW, and task characteristics are relatively evenly distributed. Table 1. shows that respondents use DAW primarily for composing, pre-production and recording. That means, recording studios are still significant factors in final music production, expecially for the tasks of mixing and mastering music. Regarding DAW software, Steinberg's Cubase dominates as a tool of choice (42%), followed by Avid Pro Tools (14%) and Apple Logic (11%). An interesting fact is that Cockos Reaper accounts for nearly 10% of the DAWs used.

**Table 1.** Descriptive statistics

| Age | Freq. | % |
|---|---|---|
| **>50** | 6 | 0,72 |
| **40-49** | 73 | 8,71 |
| **30-39** | 348 | 41,53 |
| **20-29** | 394 | 47,02 |
| **16-19** | 17 | 2,03 |
| **Total** | 838 | 100 |

| Country | Freq. | % |
|---|---|---|
| **Germany** | 73 | 8,71 |
| **Sweden** | 69 | 8,23 |
| **Spain** | 65 | 7,76 |
| **Italy** | 55 | 6,56 |
| **Poland** | 52 | 6,21 |

| Experience with DAW | Freq. | % |
|---|---|---|
| **more than 5 years** | 332 | 39,62 |
| **between 1 and 5 years** | 414 | 49,40 |
| **less than 1 year** | 92 | 10,98 |
| **Total** | 838 | 100 |

| Task Characteristics* | Freq. | % |
|---|---|---|
| **Composing** | 564 | 23,09 |
| **Pre-production** | 598 | 24,48 |
| **Recording** | 603 | 24,68 |
| **Mixing** | 427 | 17,48 |
| **Mastering** | 251 | 10,27 |
| **Total** | 2443 | 100 |

| | | |
|---|---|---|
| **Finland** | 48 | 5,73 |
| **UK** | 48 | 5,73 |
| **Greece** | 34 | 4,06 |
| **Netherlands** | 34 | 4,06 |
| **Russia** | 34 | 4,06 |
| **Norway** | 27 | 3,22 |
| **Portugal** | 26 | 3,10 |
| **Croatia** | 22 | 2,63 |
| **Hungary** | 22 | 2,63 |
| **Czech Rep.** | 21 | 2,51 |
| **France** | 21 | 2,51 |
| **Switzerland** | 20 | 2,39 |
| **Other** | 187 | 22,32 |
| **Total** | 838 | 100 |

| DAW software* | Freq. | % |
|---|---|---|
| **Steinberg Cubase/Nuendo** | 454 | 42,08 |
| **Avid Pro Tools** | 151 | 13,99 |
| **Apple Logic** | 116 | 10,75 |
| **Cockos Reaper** | 103 | 9,55 |
| **Adobe Audition** | 50 | 4,63 |
| **Image-Line FL Studio** | 47 | 4,36 |
| **Cakewalk Sonar** | 36 | 3,34 |
| **Other** | 122 | 11,31 |
| **Total** | 1079 | 100 |

* multiple-choice answers

The survey included one open-ended question, enabling respondents to provide additional information regarding their DAW configuration. A special emphasis was put on the computer system configuration, DSP processors usage, audio interface, plugins, virtual instruments and external gear used. 391 out of 838 respondents provided detailed answers in text form. To extract useful information, R programming language with "tm" and "wordcloud" packages was used to perform text mining and data visualization. The wordcloud (Figure 2.) indicates most frequent brands of plugins, audio interfaces and computer systems reported.

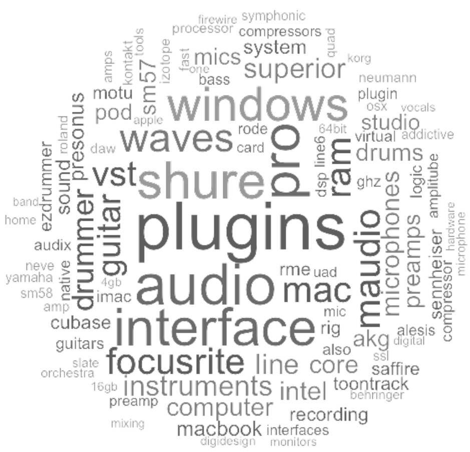


**Fig.2.** Users' reported DAW equipment word cloud (Source: Author's calculations)

*3.2. Operationalization and measurement of variables*

Indicators for the latent variables were operationalized from prior studies and adapted for this research requirements. Special attention was put on the Task Characteristics and Tool Characteristics. Most frequent tasks were mapped form previous DAW studies and analyzed through a comparison of respondents' satisfaction with specific DAW functions and the usage frequencies of those functions, for the tasks of composing, pre-production, recording, mixing and mastering.

**Table 2.** DAW functions map

| Tool Functions | Satisfaction | | Usage Frequency | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| Drag and drop to import, arrange, and render | 4,1038 | 0,7806 | 7,7709 | 2,1850 |
| Mix audio, MIDI on any track | 4,0967 | 0,7738 | 7,6384 | 2,3670 |
| Move, split, glue, resize, trim, loop, time stretch, pitch shift, fade, crossfade, slip, snap to grid | 4,1635 | 0,8081 | 8,1611 | 2,0488 |
| Zoom, scroll, scrub, jog, tab to audio transient, MIDI navigation | 3,9033 | 0,8390 | 7,6695 | 2,3462 |
| Group editing, routing, bussing | 3,8234 | 0,8550 | 6,7100 | 2,5500 |
| Automation recording, playback, and editing support for track controls and plug-ins | 3,8604 | 0,8401 | 6,7816 | 2,4139 |
| Manage tempo, time signature, and varispeed changes | 3,8126 | 0,9129 | 7,0644 | 2,4632 |
| Separate audio or MIDI into freely arrangeable takes and lanes for easy comping | 3,7422 | 0,8595 | 6,4415 | 2,5486 |
| Copy or move regions, to quickly try out alternate arrangements | 4,0251 | 0,8498 | 7,3449 | 2,3996 |

The respondents are most satisfied with DAW's basic editing functions (Mean: 4,16; St.Dev.: 0,8), which is the most used

DAW function (Mean: 8,16; St.Dev.: 2,05). Table 2. shows that correlation exists between satisfaction with tool functions and usage frequency of those functions. That was the key to link technology characteristics and task characteristics with the TTF construct for this research. The TTF construct was adapted from prior studies /**11**/, /**12**/ and reduced in the number of indicators used. As for the whole model, a survey with a total of 49 items was created, special caution was devoted to survey lenght, for the prupose of effort and error reduction. The survey items related to each construct included in the model were measured using a five-point Likert scale. All items ranged from 1 (strongly disagree) to 5 (strongly agree). The survey items related to Technology characteristics were mesured with satisfaction degree (1 – very unsatisfied to 5 – very satisfied). Task characteristics was measured using a ten-point Likert scale, with survey items relating to the frequency of performing a specific task.

*3.3. Model assessment*

This research is based on Partial Least Squares Structural Equation Modeling (PLS-SEM) to develop a model that represents the relationships among the nine proposed constructs measured by 49 items. The PLS is a multivariate technique for assessing structural models (from: Wold, 1985.). The software tool WarpPLS 4.0 was used to assess the measurement and the structural model of the research. A confirmatory factor analysis (CFA) was employed to establish the reliability of the items and the convergent and discriminant validity of the constructs. This is crucial for the assessment of the measurement model. The factor structure matrix of item loadings and cross-loadings (Table 3.) confirms that the convergent validity of each construct is achieved as the item loadings for each construct are above the threshold of 0.708 (Hair et al., 2014). 16 items didn't meet the minimum requirements and were removed from the model.

**Table 3.** Factor structure matrix of loadings and cross-loadings

| | ATT | EXP | PEOU | PU | TASK | TECH | TTF | USAGE | INTU |
|---|---|---|---|---|---|---|---|---|---|
| **ATT1** | 0,848 | 0,220 | 0,451 | 0,537 | 0,379 | 0,453 | 0,455 | 0,297 | 0,574 |
| **ATT2** | 0,843 | 0,196 | 0,432 | 0,536 | 0,358 | 0,447 | 0,424 | 0,292 | 0,551 |
| **ATT3** | 0,835 | 0,173 | 0,372 | 0,530 | 0,318 | 0,402 | 0,406 | 0,252 | 0,558 |
| **ATT4** | 0,850 | 0,238 | 0,456 | 0,580 | 0,350 | 0,442 | 0,451 | 0,324 | 0,600 |
| **EXP** | 0,246 | 1,000 | 0,290 | 0,254 | 0,240 | 0,168 | 0,126 | 0,590 | 0,301 |
| **PEOU1** | 0,486 | 0,302 | 0,834 | 0,499 | 0,390 | 0,476 | 0,487 | 0,345 | 0,472 |
| **PEOU2** | 0,457 | 0,284 | 0,862 | 0,482 | 0,416 | 0,518 | 0,524 | 0,318 | 0,474 |
| **PEOU4** | 0,356 | 0,204 | 0,799 | 0,431 | 0,350 | 0,426 | 0,406 | 0,270 | 0,368 |
| **PEOU5** | 0,338 | 0,128 | 0,775 | 0,386 | 0,332 | 0,404 | 0,396 | 0,204 | 0,315 |
| **PU1** | 0,498 | 0,223 | 0,451 | 0,750 | 0,285 | 0,375 | 0,403 | 0,262 | 0,463 |
| **PU2** | 0,492 | 0,217 | 0,434 | 0,798 | 0,364 | 0,392 | 0,423 | 0,298 | 0,482 |
| **PU3** | 0,412 | 0,107 | 0,390 | 0,720 | 0,284 | 0,359 | 0,360 | 0,223 | 0,378 |
| **PU5** | 0,538 | 0,245 | 0,475 | 0,794 | 0,331 | 0,367 | 0,403 | 0,304 | 0,534 |
| **PU6** | 0,509 | 0,188 | 0,391 | 0,765 | 0,338 | 0,428 | 0,446 | 0,250 | 0,489 |
| **PU7** | 0,492 | 0,161 | 0,382 | 0,734 | 0,353 | 0,409 | 0,413 | 0,296 | 0,518 |
| **TASK2** | 0,320 | 0,183 | 0,364 | 0,359 | 0,743 | 0,488 | 0,363 | 0,267 | 0,374 |
| **TASK3** | 0,351 | 0,230 | 0,345 | 0,343 | 0,783 | 0,511 | 0,373 | 0,304 | 0,404 |
| **TASK4** | 0,309 | 0,178 | 0,300 | 0,291 | 0,781 | 0,467 | 0,329 | 0,235 | 0,323 |
| **TASK5** | 0,320 | 0,167 | 0,389 | 0,334 | 0,774 | 0,480 | 0,342 | 0,308 | 0,351 |
| **TASK6** | 0,278 | 0,148 | 0,339 | 0,301 | 0,724 | 0,411 | 0,295 | 0,264 | 0,299 |
| **TECH1** | 0,395 | 0,106 | 0,430 | 0,426 | 0,412 | 0,755 | 0,499 | 0,200 | 0,439 |
| **TECH2** | 0,403 | 0,109 | 0,435 | 0,369 | 0,502 | 0,750 | 0,455 | 0,241 | 0,412 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **TECH3** | 0,420 | 0,154 | 0,386 | 0,402 | 0,469 | 0,776 | 0,506 | 0,231 | 0,435 |
| **TECH4** | 0,379 | 0,116 | 0,430 | 0,357 | 0,460 | 0,791 | 0,475 | 0,193 | 0,402 |
| **TECH5** | 0,374 | 0,155 | 0,458 | 0,391 | 0,528 | 0,738 | 0,439 | 0,286 | 0,416 |
| **TTF1** | 0,389 | 0,064 | 0,402 | 0,416 | 0,331 | 0,518 | 0,799 | 0,157 | 0,407 |
| **TTF2** | 0,438 | 0,133 | 0,440 | 0,430 | 0,404 | 0,518 | 0,813 | 0,181 | 0,455 |
| **TTF3** | 0,326 | 0,038 | 0,397 | 0,333 | 0,290 | 0,419 | 0,751 | 0,117 | 0,350 |
| **TTF9** | 0,425 | 0,143 | 0,481 | 0,468 | 0,352 | 0,462 | 0,725 | 0,253 | 0,424 |
| **USAGE** | 0,346 | 0,590 | 0,354 | 0,360 | 0,364 | 0,302 | 0,234 | 1,000 | 0,406 |
| **INTU1** | 0,603 | 0,250 | 0,447 | 0,541 | 0,348 | 0,440 | 0,445 | 0,339 | 0,845 |
| **INTU2** | 0,469 | 0,241 | 0,372 | 0,498 | 0,441 | 0,466 | 0,425 | 0,353 | 0,774 |
| **INTU3** | 0,588 | 0,250 | 0,423 | 0,515 | 0,358 | 0,458 | 0,443 | 0,310 | 0,842 |

The verification of the reliability of indicators was obtained using Cronbach's alpha, testing the contribution made by each indicator to be similar, as well as the composite reliability coefficient which takes respective indicators into account. Convergent validity, measured by Average Variance Extracted (AVE), represents the common variance between the indicators and their construct and should be higher than 0.5. In order to confirm the discriminant validity among constructs (Fornell-Lacker criterion) the AVE square root must be superior to the correlation between constructs. Table 4. indicates the Cronbach's Alpha coefficient, Composite reliability coefficient, Average Variance Extracted (AVE) along with the square roots of the AVE (highlighted numbers in the diagonal) and the correlation between constructs.

**Table 4.** Cronbach's alpha, Composite Reliability, Average Variance Extracted (AVE) and Discriminant Validity of the constructs

| | ATT | EXP | INTU | PEOU | PU | TASK | TECH | TTF | USAGE |
|---|---|---|---|---|---|---|---|---|---|
| **Cronbach Alpha** | 0,865 | 1,000 | 0,757 | 0,836 | 0,854 | 0,819 | 0,819 | 0,775 | 1,000 |
| **Composite Reliability** | 0,908 | 1,000 | 0,861 | 0,890 | 0,892 | 0,873 | 0,874 | 0,855 | 1,000 |
| **AVE** | 0,712 | 1,000 | 0,674 | 0,670 | 0,579 | 0,580 | 0,581 | 0,597 | 1,000 |
| **ATT** | 0,844 | | | | | | | | |
| **EXP** | 0,246 | 1,000 | | | | | | | |
| **INTU** | 0,677 | 0,301 | 0,821 | | | | | | |
| **PEOU** | 0,508 | 0,290 | 0,506 | 0,818 | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **PU** | 0,647 | 0,254 | 0,631 | 0,554 | 0,761 | | | | |
| **TASK** | 0,416 | 0,240 | 0,463 | 0,458 | 0,430 | 0,761 | | | |
| **TECH** | 0,517 | 0,168 | 0,552 | 0,561 | 0,511 | 0,622 | 0,762 | | |
| **TTF** | 0,515 | 0,126 | 0,533 | 0,560 | 0,538 | 0,449 | 0,623 | 0,773 | |
| **USAGE** | 0,346 | 0,590 | 0,406 | 0,354 | 0,360 | 0,364 | 0,302 | 0,234 | 1,000 |

* square root of AVE on diagonal

After establishing the reliability for the items and the convergent and discriminant validity of the constructs, the structural model was assessed. The results of the PLS analysis for the hypotheses H1 to H6 are shown in Figure 3.

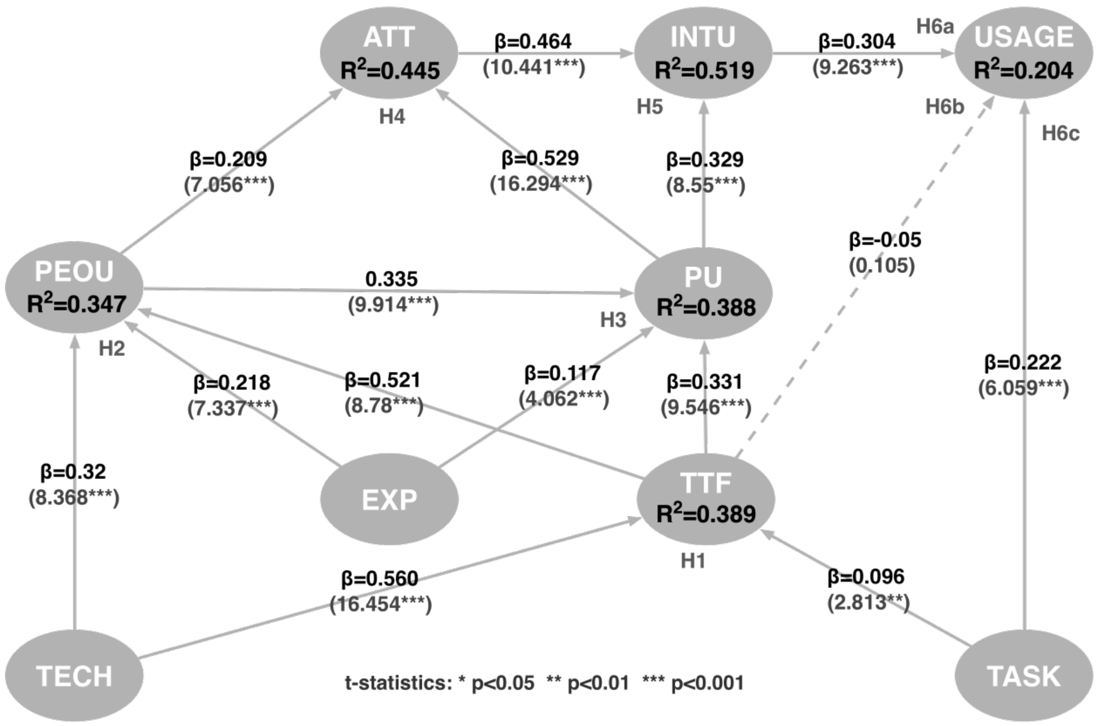


**Fig.3.** Integrated model results (Source: Author's calculations)

The model shows no collinearity problems, as the average block variance inflation factor VIF (AVIF)=1.395 (acceptable if ≤5) and the average full collinearity VIF (AFVIF)=2.007 (acceptable if ≤5). The average path coefficient (APC) is 0.326 (p<0,001) while the average R-squared (ARS) is 0.382 (p<0,001) and the average adjusted R-squared (AARS) is 0.38 (p<0,001). The predictive capability of the model is satisfactory because all R-Squares are higher than 0.1 (Table 5.) although they are rather weak, with the exception of Intentions to use, which can be interpreted as moderate ($R^2$=0.519). The Usage construct ($R^2$=0.204) has the lowest R-Square, confirming prior research that utilization needs further investigation to better understand it.

**Table 5.** Latent variable coefficients

| | ATT | IN-TU | US-AGE | PEOU | PU | EXP | TTF | TASK | TECH |
|---|---|---|---|---|---|---|---|---|---|
| **1. R-squared coefficients** | 0.445 | 0.519 | 0.204 | 0.347 | 0.388 | | 0.389 | | |
| **2. Adjusted R-squared coeff.** | 0.444 | 0.518 | 0.202 | 0.345 | 0.386 | | 0.388 | | |
| **3. Full collinearity VIFs** | 2.243 | 2.357 | 1.760 | 1.860 | 2.167 | 1.576 | 1.969 | 1.762 | 2.367 |
| **4. Q-squared coefficients** | 0.445 | 0.519 | 0.204 | 0.347 | 0.388 | | 0.390 | | |

All path coefficients are positive and significant (99,9% confidence level, p < 0,001) except the path coefficient between Task Characteristics and Task-Technology Fit (99%, p < 0,01). The path coefficient between Task-Technology Fit and Usage is found not significant. Consequently, all the hypotheses are supported except the hypothesis H6b. The Path coefficients, the indirect and total effects, along with their corresponding effect sizes for the structural model are summarized in Table 6.

**Table 6.** Path coefficients, indirect and total effects and corresponding effect sizes

| | | ATT | INTU | PEOU | PU | EXP | TTF | TASK | TECH |
|---|---|---|---|---|---|---|---|---|---|
| **Attitude towards Use** | PATH CO-EFF. | | | 0.209 | 0.529 | | | | |
| | effect size | | | 0.105 | 0.341 | | | | |
| | INDIRECT FX | | | 0.177 | | 0.146 | 0.376 | 0.036 | 0.211 |
| | effect size | | | 0.088 | | 0.036 | 0.191 | 0.015 | 0.109 |
| | TOTAL FX | | | 0.386 | 0.529 | 0.146 | 0.376 | 0.036 | 0.211 |
| | effect size | | | 0.193 | 0.341 | 0.036 | 0.191 | 0.015 | 0.109 |
| **Intentions to Use** | PATH CO-EFF. | 0.464 | | | 0.329 | | | | |
| | effect size | 0.313 | | | 0.206 | | | | |
| | INDIRECT FX | | | 0.289 | 0.245 | 0.131 | 0.341 | 0.033 | 0.191 |
| | effect size | | | 0.144 | 0.154 | 0.039 | 0.180 | 0.015 | 0.105 |
| | TOTAL FX | 0.464 | | 0.289 | 0.574 | 0.131 | 0.341 | 0.033 | 0.191 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | effect size | 0.313 | | 0.144 | 0.360 | 0.039 | 0.180 | 0.015 | 0.105 |
| **Usage** | PATH CO-EFF. | | 0.304 | | | | | 0.222 | |
| | effect size | | 0.124 | | | | | 0.080 | |
| | INDIRECT FX | 0.141 | | 0.088 | 0.175 | 0.040 | 0.104 | 0.010 | 0.058 |
| | effect size | 0.049 | | 0.031 | 0.062 | 0.023 | 0.023 | 0.004 | 0.017 |
| | TOTAL FX | 0.141 | 0.304 | 0.088 | 0.175 | 0.040 | 0.104 | 0.231 | 0.058 |
| | effect size | 0.049 | 0.124 | 0.031 | 0.062 | 0.023 | 0.023 | 0.084 | 0.017 |
| **Perceived Ease of Use** | PATH CO-EFF. | | | | | 0.218 | 0.521 | | |
| | effect size | | | | | 0.061 | 0.286 | | |
| | INDIRECT FX | | | | | | | 0.050 | 0.292 |
| | effect size | | | | | | | 0.023 | 0.163 |
| | TOTAL FX | | | | | 0.218 | 0.521 | 0.050 | 0.292 |
| | effect size | | | | | 0.061 | 0.286 | 0.023 | 0.163 |
| **Perceived Usefulness** | PATH CO-EFF. | | | 0.335 | | 0.117 | 0.331 | | |
| | effect size | | | 0.184 | | 0.030 | 0.175 | | |
| | INDIRECT FX | | | | | 0.073 | 0.175 | 0.048 | 0.283 |
| | effect size | | | | | 0.018 | 0.092 | 0.021 | 0.144 |
| | TOTAL FX | | | 0.335 | | 0.191 | 0.505 | 0.048 | 0.283 |
| | effect size | | | 0.184 | | 0.048 | 0.267 | 0.021 | 0.144 |
| **Task-Technology Fit** | PATH CO-EFF. | | | | | | | 0.096 | 0.560 |
| | effect size | | | | | | | 0.042 | 0.347 |
| | TOTAL FX | | | | | | | 0.096 | 0.560 |
| | effect size | | | | | | | 0.042 | 0.347 |

## 4. DISCUSSION

The structural model shows resonable confirmation of the integrated TAM/TTF model. By analysing the direct, indirect and total effects, it is evident that DAW usage is explained by the intentions to use (β=0.304, p<0,001) and the task characteristics (β=0.222, p<0,001). Task-Technology Fit shows no direct link to usage, but affects usage indirectly through the TAM variables. The explanation for this outcome can be found in the number of indicators used for the TTF construct. Nevertheless, this relation is conforming to Dishaw & Strong and Goodhue & Thompson's studies. While personal experience with DAW shows weak effects, TTF strongly affects the perceived ease of use (β=0.521, p<0,001) and moderately affects the perceived usefulness (β=0.331, p<0,001). The attitude towards use is strongly affected by the perceived usefulness (β=0.529, p<0,001). It can be summarized that PEOU mediates the relation between TTF and PU, PU is the mediator between PEOU and ATT, and ATT is the mediator between PU and INTU. The usage R-squared is weak, thus the usage frequencies of the DAW functions were mapped to gather deeper insight into the activities DAW users perform while using DAW software for their specific tasks. Intentions to use's moderate R-square provides modest explanation of the DAW usage antecedents. DAW providers should foster the critical useful functions reported by users and focus on the improvement of the usefulness and ease of use of the weaker rated functions. A clear and understandable GUI saves time for the users to perform the intended tasks. It also allows them to accomplish more work than would otherwise be possible. As DAW relibility is highly valued by end-users, special care should be devoted to system maintenance and customer support. Such activities will result in better alignment of the DAW functions and capabilities and the artists' needs. As a result, artists will be more satisfied with their DAW software of choice which will drive the DAW acceptance and use.

## 5. CONCLUSION

The Digital audio workstation usage has a profound impact on the music industry. The information technology advances enabled artists to compose, record and produce music in ways it was impossible before. This research was motivated by the need for better understanding of the motivations that drive DAW usage among hard rock and heavy metal artists.

Based on the integrated TAM/TTF model, the research provided significant and important findings for both information systems researchers and DAW providers.

As with all studies, limitations are present in this study. The task-technology fit was never adapted for the context of digital audio workstations, and needs further attention and refinement. Furthermore, a multi-group analysis could provide more information regarding the relationship between specific constructs. Regardless, the results of this globaly conducted study fulfill the objectives, offering valuable insight into the DAW usage antecedents.

*Notes*

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