# Acceptance of Cryptocurrencies in E-Commerce: Consumers' Perspective Using a Proposed Cryptocurrency Technology Acceptance Model (CCTAM)

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## Abstract

The usage of cryptocurrencies as a payment method in e-commerce is rather limited in the DACH region. The acceptance to use them depends on various factors. Some are and some are not discussed in the literature, so the aim of this study is to provide a comprehensive picture of which factors influence the acceptance of cryptocurrencies and evaluate them using a custom-developed cryptocurrency acceptance model (CCTAM) and Partial Least Squares-Structural Equation Modelling (PLS-SEM). The data was collected through an online questionnaire with 341 respondents. The results show that all the factors identified have a certain degree of significance, but only the effect of Facilitating Conditions (FC) on the Perceived Ease of Use (PEoU) is negligible. Most notable, however, is the strong explanatory power of the construct Attitude (A), which can explain 72.3% of the total variance, indicating a good fit of the model.



*Keywords: Cryptocurrencies, Online Payment, TAM*

*Track: Retailing & Omni-Channel Management*

# 1 Introduction

In 2008, the world experienced the biggest financial crisis since Black Thursday in 1929. This crisis resulted in a loss of nearly 2% of the global gross domestic product (GDP) and is arguably the reason why confidence in established systems such as banks and their regulating authorities was severely shaken. (Sixt, 2017; Wenger & Tokarski, 2020). For many, it was therefore no coincidence that Satoshi Nakamoto's white paper "Bitcoin - A Peer-to-Peer Electronic Cash System" was published just in the middle of the great crisis (Wenger & Tokarski, 2020). With his new creation, the Bitcoin, he replaced trust by cryptographic proof “allowing any two willing parties to transact directly with each other without the need for a trusted third party” (Nakamoto, 2008) While the first transactions still took place between technically experienced enthusiasts, interest grew very strongly in recent years. The usage, as well as the acceptance of cryptocurrencies depends very much on the general attitude towards the available payment options of the respective regions (Bagnall et al., 2016). A study shows that for example, Germany and Austria, where 80% of transactions are paid by cash, are still very cash-oriented - in comparison to the USA, where only approx. 50% is paid for with cash. (Blocher et al. 2017).

# 2. Theoretical Background and Literature Review

Although there are already online merchants who accept cryptocurrencies (at least Bitcoin), the spread is rather low. The use of Bitcoin as a means of payment is also comparatively rare, as cryptocurrencies (especially Bitcoin) often have a second characteristic, namely as an investment asset (Polasik et al., 2015). Other researchers see cryptocurrencies as having the potential to replace traditional payment providers, at least for online payments, provided that the extreme volatility is brought under control (Yermack, 2016). Apart from their high volatility, cryptocurrencies already offer strong arguments in favor of their acceptance as a means of payment. Especially in the area of cross-border transactions, cryptocurrencies can offer enormous advantages over traditional payment transactions. Both advantages in the speed of transactions and financial benefits are discussed by experts (Wenger & Tokarski, 2020).

There is currently relatively little literature on the acceptance of cryptocurrencies in online commerce. The majority of the existing literature deals with acceptance from the customer’s perspective (Kbilashvili, 2018; Mendoza-Tello, Mora, Pujol-López & Lytras, 2019; Parashar & Rasiwala 2019; Goundar, Chand, Tafsil, Reema & Reshma, 2020; Bezovski, Davcev, Mitreva, 2021), where most of the papers that implement acceptance models consider rather few possible influencing factors (Arias-Oliva, Pelegrin-Borondo & Matias-Clavero, 2019; Mendoza-Tello, Mora, Pujol-López & Lytras, 2019; Sohaib et al., 2020; Gil-Cordero, Caberra-Sanchez & Arras-Cortes, 2020; Ji-Xi, Salamzadeh & Teoh, 2021).

This paper aims to analyze the factors influencing the acceptance of cryptocurrencies by customers in the DACH region. This is done by illuminating the topic of cryptocurrencies as a means of payment itself. On the one hand, to understand the developments in this research area and on the other hand, to explain the factors that affect the acceptance of cryptocurrencies as a payment method from the user's perspective. Furthermore, the acceptance research itself will be highlighted, with a special focus on technology acceptance. Within this framework, two well-known technology acceptance models are presented. Consequently, the insights gained about cryptocurrencies will be used to develop the proposed acceptance model framework, which is further on evaluated by means of partial least squares structural equation modeling (PLS-SEM).

## 3 Theoretical framework and hypotheses

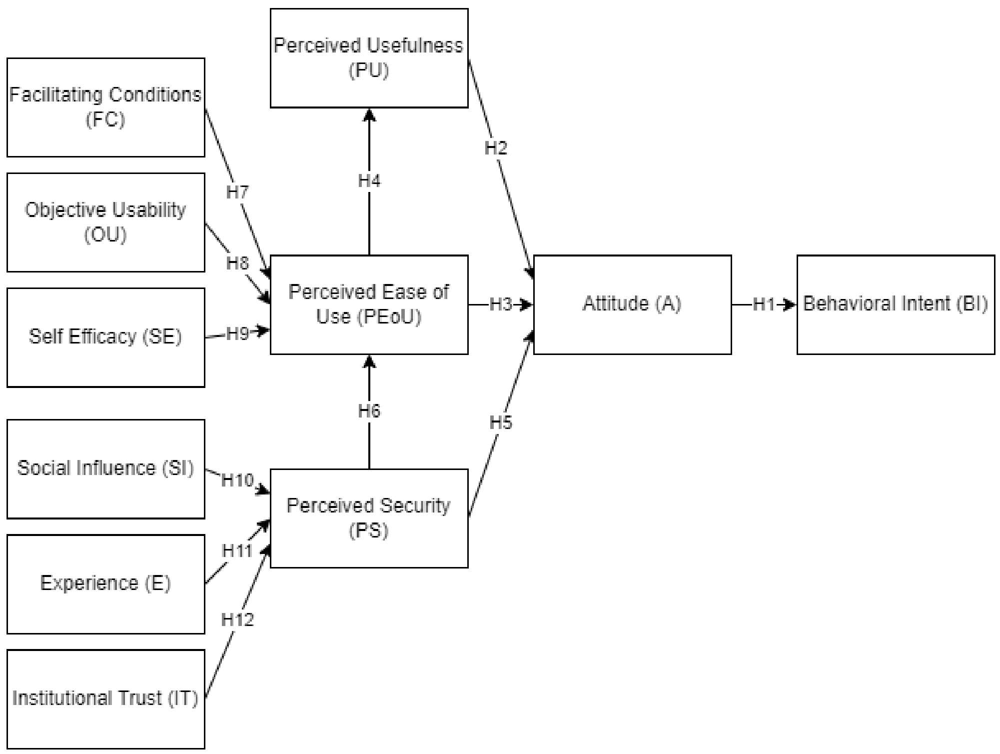
The Technology Acceptance Model (TAM) was developed by Fred Davis in 1987 in order to find out the user acceptance of internal information systems. According to Davis, the lack of user acceptance is the main obstacle to the success of an information system. The TAM was developed from the Theory of Reasoned Action (Ajzen, Fishbein & Heilbroner, 1980) and can be considered a continuation of this model. Both describe that a person's behavior is determined by their intention to perform the behavior (Albayati et al., 2020)

TAM assumes that the behavioral intention to use a technology is influenced by the two core factors Perceived Usefulness and the Perceived Ease of Use. External variables, such as training and system design features, have an impact on the perceived usefulness and ease of use (Davis & Venkatesh, 2004). The easier a technology is to use, the more useful it is. This means that the Perceived Ease of Use (PEOU) can also influence the Perceived Usefulness (PU) (Venkatesh, 2000). In many studies in the area of user acceptance of technologies, the Behavioral Intent to Use (BI) is the strongest predictive variable for user behavior. Furthermore, Davis' technology acceptance model is also based on the fact that user intent is the best predictor of user behavior (Davis &Venkatesh, 2004).

In the proposed acceptance model, TAM is extended with factors derived from the Unified Theory of Acceptance and Use of Technology. UTAUT is based on eight competing technology acceptance models, among which is Fred Davis' Technology Acceptance Model. The model is mainly based on 4 theoretical constructs: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions, which represent decisive parameters of the behavioral intention to use as well as the use behavior as a substitute of the technology acceptance. In addition to those construct moderating factors including: Age, Gender, Experience as well as Voluntariness to Use are proposed. (Venkatesh, Morris, Davis & Davis, 2003).

TAM is still one of the most widely used technology acceptance models, and rightly so, because it has already produced many high-quality results in research. However, the TAM needs to be adapted every now and then to fit the particular research context (Albayati et al., 2020). For this reason, a model based on the TAM will be developed specifically for this work. The model will be extended by factors of the UTAUT model and the TAM3, a further development of the TAM. Furthermore, figure 1 shows the proposed cryptocurrency technology acceptance model (CCTAM) graphically. As shown 12 hypotheses can be derived for empirical research.

**figure 1**: proposed cryptocurrency technology acceptance model (CCTAM)



The following table 1 shows the definition of the theoretical constructs in the model and how they are conceptualized:

**table 1**: conzeptualisation of theoretical constructs

| theoretical construct | conceptualization | source |
|---|---|---|
| **Facilitating Conditions** | The extent to which users believe that the existing organizational and technical infrastructure is sufficient to support their use of the technology. | (Venkatesh et al., 2003) |
| **Self Efficacy** | Self-Efficacy indicates how likely users think it is that they will be able to perform their task with the help of the new technology. | (Venkatesh & Bala, 2008) |
| **Objective Usability** | Analysis of the effort of the new technology compared to technologies already known or in use. | (Venkatesh, 2000) |
| **Social Influence** | This includes all norms and values that influence what behavior is considered correct. The factor also includes how the use of the technology is perceived by the social and professional environment of the users. | (Albayati et al., 2020; Venkatesh et al., 2003) |
| **Experience** | The existing experience with the matter and the existing knowledge about the technology. | (Albayati et al., 2020) |
| **Institutional Trust** | The confidence of users in official regulations and legal provisions. | (Albayati et al., 2020) |
| **Perceived Usefulness** | How useful the introduction of the new technology is perceived by the users. | (F. Davis & Venkatesh, 2004b) |
| **Perceived Ease of Use** | The user's expectation of the effort involved in using the new technology. | (F. Davis & Venkatesh, 2004b) |
| **Perceived Security** | The degree to which users consider the new technology to be safe. | (Albayati et al., 2020) |
| **Attitude** | The attitude of the users towards the new technology. | (F. D. Davis, 1989) |
| **Behavioral Intent** | The perceived likelihood that users will use the new technology. | (F. D. Davis, 1989) |

## 4 Methodology

To answer the central research question on which factors influence the acceptance of cryptocurrencies as a means of payment in e-commerce, a quantitative survey based on the Technology Acceptance Model (Davis, 1989) is carried out using an online questionnaire as a survey instrument. Participants were reached through non-probability sampling via e-mail. Regarding the sample composition, the majority of the 341 customer responses (226 female, 115 male) were probably derived from people with the same university background, since mailing lists from the university were used in order to distribute the survey more efficiently. 53.3% of the participants are between 18 and 35 years old, 26.1% between 36 and 50 and 21.6% between 51 and 65. 46% have a university degree, 36.1% have a baccalaureate, 15.2% have an apprenticeship and 2.7% compulsory education. Partial Least Squares-Structural Equation Modelling (PLS-SEM) with XLStat is used for the statistical analysis. Since this study is exploratory based, PLS-SEM is considered a suitable approach for such type of studies. In terms of the measurement model, it is suggested that researchers should consider the loadings of the items and the average variance extracted (AVE) in order to establish the convergent validity (Hair, Hult, Ringle & Sarstedt, 2014). Additionally, Hair et al. (2014) suggest cross loadings to establish discriminant validity Furthermore, Ravand et al. (2016) suggest D.G. Rho to establish composite reliability. In terms of the structural model, path coefficients and the associated p-Values, effect sizes ($f^2$), as well as the coefficient of determination ($R^2$) will be measured (Hair, Hult, Ringle & Sarstedt, 2014). Accordingly, all the aforementioned criteria will be assessed to validate the measurement as well as the structural model.

## 5 Results

As mentioned before, a two-stage analytical approach is used when assessing the model via PLS-SEM (Hair, Risher, Sarstedt, & Ringle, 2019)

### *5.1 Measurement model*

In order to measure the reliability of each item, the loadings of the manifest variables should be measured. Hair et al. (2019) state that “*0.708 are recommended, as they indicate that the construct explains more than 50 per cent of the indicator’s variance*” For composite reliability Hair, Ringle & Sarstedt (2011) point out that values above 0.9 are regarded as excellent, higher than 0.8 are fine, higher than 0.7 are adequate, higher than 0.6 are acceptable, and lower than 0.6 are substandard. The average variance extracted (AVE) is defined as the grand mean value of the squared loadings of the items related to the construct and the common measure for establishing the convergent validity. A value of AVE $\geq 0.5$ is considered sufficiently high, meaning that at least half of the variance of a construct is explained due to the indicators associated with it (Ringle & Spreen, 2007).

**table 2**: loadings, composite reliability & AVE

| **Construct** | **Items** | **Loadings** | **Composite reliability** | **AVE** |
|---|---|---|---|---|
| **FC** | FC1<br>FC2 | 0.912<br>0.477 | 0.673 | 0.530 |
| **SE** | SE1<br>SE2<br>SE3 | 0.737<br>0.852<br>0.828 | 0.848 | 0.652 |
| **OU** | OU1<br>OU2 | 0.741<br>0.837 | 0.849 | 0.653 |

| | | | | |
|---|---|---|---|---|
| | OU3 | 0.841 | | |
| **SI** | SI1<br>SI2<br>SI3 | 0.704<br>0.794<br>0.852 | 0.828 | 0.617 |
| **E** | E1<br>E2<br>E3<br>E4 | 0.898<br>0.810<br>0.806<br>0.898 | 0.915 | 0.730 |
| **IT** | IT1<br>IT2<br>IT3<br>IT4<br>IT5 | 0.927<br>0.634<br>0.745<br>0.797<br>0.855 | 0.868 | 0.571 |
| **PU** | PU1<br>PU2<br>PU3 | 0.901<br>0.917<br>0.841 | 0.916 | 0.785 |
| **PeoU** | PEoU1<br>PEoU2<br>PEoU3 | 0.856<br>0.721<br>0.822 | 0.843 | 0.643 |
| **PS** | PS1<br>PS2 | 0.891<br>0.914 | 0.898 | 0.785 |
| **A** | A1<br>A2<br>A3<br>A4 | 0.897<br>0.797<br>0.896<br>0.867 | 0.922 | 0.749 |
| **BI** | BI1<br>BI2<br>BI3 | 0.919<br>0.868<br>0.957 | 0.939 | 0.838 |

Also, cross-loadings were considered as a source to verify discriminant validity. When looking at cross-loadings, it is examined that an item doesn’t load highly on multiple constructs (Henseler, Ringle & Sarstedt, 2015). Cross loadings for each construct are very low, thus indicating strong discriminant validity.

*5.2 Structural model*

$R^2$ is a measure of the variance, which is explained in each of the endogenous constructs, therefore indicating the model’s explanatory power (Shmueli and Koppius, 2011). According to Chin (1998) R2 values > 0.67 indicate a high, between 0.33 and 0.67 moderate, and between 0.19 and 0.33 low explanatory power. The values are demonstrated in table 3.

**table 3**: $R^2$ values of the endogenous constructs

| **Latent Variable** | $R^2$ |
|---|---|
| **PS** | 0.534 |
| **PeoU** | 0.498 |
| **PU** | 0.403 |
| **A** | 0.723 |
| **BI** | 0.577 |

Next path coefficients, as well as the respective p-values for each hypothesis, were evaluated as shown in Figure 2 and table 4:

**table 4**: hypotheses test results

| Hypothesis | Path | Path coefficient | p-value | $f^2$ | Supported? |
|---|---|---|---|---|---|
| **H1** | **A -> BI** | 0.759 | < .001 | 1.362 | yes |
| **H2** | **PU -> A** | 0.556 | < .001 | 0.524 | yes |
| **H3** | **PEoU -> A** | 0.151 | < .001 | 0.042 | yes |
| **H4** | **PEoU -> PU** | 0.635 | < .001 | 0.676 | yes |
| **H5** | **PS -> A** | 0.238 | < .001 | 0.092 | yes |
| **H6** | **PS -> PEoU** | 0.425 | < .001 | 0.206 | yes |
| **H7** | **FC -> PEoU** | 0.105 | .014 | 0.018 | (no) |
| **H8** | **OU -> PEoU** | 0.175 | < .001 | 0.039 | yes |
| **H9** | **SE -> PEoU** | 0.168 | .001 | 0.035 | yes |
| **H10** | **SI -> PS** | 0.311 | < .001 | 0.135 | yes |
| **H11** | **E -> PS** | 0.202 | < .001 | 0.059 | yes |
| **H12** | **IT -> PS** | 0.397 | < .001 | 0.262 | yes |

As for the proposed model it can be noticed, that all of the hypotheses can be supported, solely looking at the respective p-values indicating significance. In addition, the moderate to high $R^2$ values as seen in table 3 indicate that the model is well suited to explain the acceptance of cryptocurrencies in the customer segment in e-commerce.

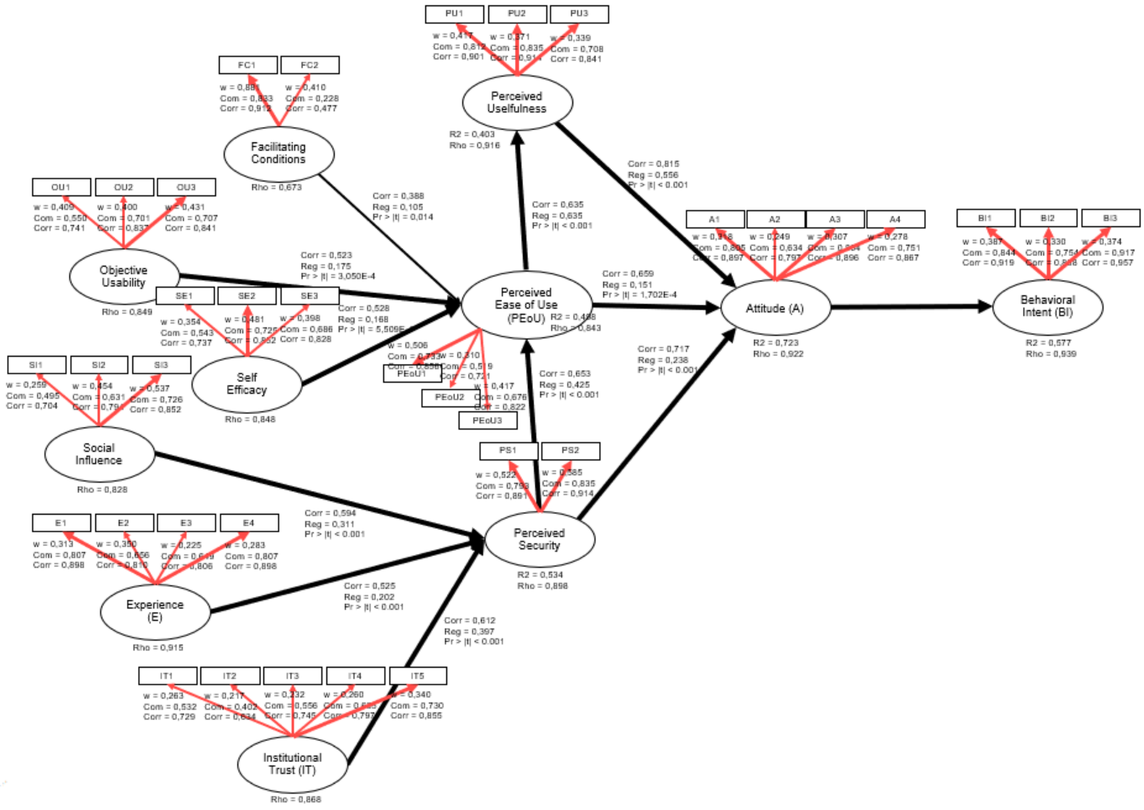



**figure 2**: XLStat – evaluated cryptocurrency technology acceptance model (CCTAM)

The only hypothesis with a path coefficient below 0.15 and an effect size below the threshold value of 0.02 as stated by Cohen (1988), is the influence of FC on PEoU ($\beta$ = 0.105, p = .014, f2 = 0.018), indicating that FC has a significant influence on PEoU, but the effect is negligible. However, when examining path coefficients, some distinctions can be observed. In particular, path coefficient values below 0.2 indicate a small, albeit in this case significant, influence of the respective relationship. Especially the influence of PEoU on A should be questioned or at least investigated in a replication study as it has the lowest path coefficient ($\beta = 0.151$, $p < .001$, $f^2 = 0.042$) observed in the study. The rather small influence of PEoU on A could also be explained by the effect of the variable PU on A.

## 6 Discussion

This study determines factors affecting the acceptance of cryptocurrencies in e-commerce by adapting technology acceptance models (TAM, UTAUT) which is further on assessed by PLS-SEM using XLStat. The outcomes for the proposed CCTAM reveal, that the model is particularly well suited for explaining the acceptance of cryptocurrencies in e-commerce with only the effect of Facilitating Conditions (FC) on the Perceived Ease of Use (PEoU) despite being significant but having a negligible effect size. This may be due to the fact, that very few merchants offer the possibility to pay by cryptocurrency as of yet. The strong explanatory power of the variable Attitude (A) however is particularly noteworthy, where 72.3% of the total variance can be explained by the endogenous construct Attitude (A), indicating substantial explanatory power (Chin, 1998).

### *6.1 Limitations and further work*

Due to the fact, that each study has its limitations, those considerations will be discussed here. The CCTAM does not claim to be complete in terms of factors influencing customers’ acceptance of cryptocurrencies as a payment method in e-commerce, but it does provide a rather broad overview of influencing factors. All factors discussed here show a certain degree of significance, which does not mean that other influencing factors may not also be important. Replication studies would be of great interest here in order to be able to test the model in other markets, not least because the use of payment methods in the DACH market is weighted differently than in other markets (Blocher et al. 2017). Furthermore, the loading of the manifest variable FC2 and based on that fact the composite reliability of the construct Facilitating Conditions (FC) is not optimal, so it should be considered in further studies to be adapted. With these things considered, a retailer focused approach would also be of great interest, although the model would have to be adapted to fit the online retailers' needs.

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