Moritz Holtmeier, Philipp Sandner Frankfurt School Blockchain Center www.fs-blockchain.de contact@fs-blockchain.de Follow us www.twitter.com/fsblockchain www.facebook.de/fsblockchain Frankfurt School of Finance & Management gGmbH Adickesallee 32-34 60322 Frankfurt am Main Germany Crypto currencies have widely been considered as an instrument to support the growth process in developing countries.Introduction The World Bank describes that "the number of poor worldwide remains un- acceptably high, and it is increasingly clear that the benefits of economic growth have been shared unevenly across regions and countries" (World Bank Group, 2018, p. 23). Along with these incidents of economic chaos, civil war and governmental collapse plague developing regions (Prahalad & Ham- mond, 2002). Besides, poverty is mainly driven by economic factors, which include limited access to financial services (Beck & Demirguc-Kunt, 2006) and high inflation rates (Aisen & Veiga, 2006). Moreover, studies have argued that a low level of trust (Barham, Boadway, Marchand, & Pestieau, 1995) and corrupt government institutions harm the economic development (Olken, 2006). Crypto currencies could provide a significant benefit by overcoming the lack of social trust and by increasing the access to financial services (Nakamoto, 1 2008) as they can be considered as a medium to support the growth process in developing countries by increasing financial inclusion, providing a better traceability of funds and to help people to escape poverty (Ammous, 2015). Introduction to crypto currencies To provide a comprehensive overview of the opportunities of crypto currencies in developing countries, it is necessary to understand the general advantages and disadvantages crypto currencies provide for users compared to central bank-issued fiat currencies, like the Euro or the US dollar, and to discuss how they emerge from the underlying technology. For this purpose, the example of two crypto currencies is used in this paper. The underlying technology of most crypto currencies is blockchain technology. A blockchain is a decentralized database that is distributed in the network on a variety of computers. It is characterized by the fact that its entries are summarized and stored in blocks. The first crypto currency discussed in this paper as an example is Bitcoin which is technically, "an algorithm that records an ongoing chain of transac- tions between members of a decentralized peer-to-peer network and broad- casts these records to all members of the network" (Ammous, 2015, p. 19).It can be said, "that (i) Bitcoin is a digital token that can be moved between parties, and (ii) the token has market value in terms of major national currencies (the token can be exchanged for [US] dollars, pounds and other currencies) and (iii) it is sporadically used--albeit often in small amounts--in exchange for real-world goods and services" (Scott, 2016, p. 3). Crypto currencies in developing counties As Expert 2 (2018) mentioned in the interview the impact of crypto currencies on the improvement of developing countries is not noteworthy yet, because the technology is still at its infant stage. In addition, Expert 2 stated, that there is currently only limited adoption of crypto currencies and the positive effects of crypto currencies will only occur if there is mass adoption (Expert 2, 2018). Similar to this view, Expert 1 (2018) argues that currently the support for the improvement process in developing countries with the help of crypto currencies is not given, mainly due to the small adoption. Expert 1 stated, that the regulation of crypto currencies is crucial for its future development and adoption because it determines which degrees of freedom and benefits crypto currencies can keep. The regulation of crypto currencies must be well balanced. They should not be too strict that all benefits are mitigated, but the regulation must be strict enough that crypto currencies are 12 politically supported, because only with political support it can come to a massive adoption of crypto currencies (Jaag & Bach, 2015). Currently, crypto currencies are generally not politically supported, because of the fear of fraud and of losing control over economic policies such as mone- teary policy (Expert 6, 2018). This result in the consequence that "the usage of crypto currencies has been prevented by different countries" (Expert 6, 2018).However, most of the countries which are declared commonly as "developing countries" have various aspects in common, which can therefore be seen as criteria for developing countries. These similarities are inadequate supply of food for large groups of the population, low per capita income and poverty, a lack of educational opportunities, a lack of access to quality health care which goes along with a high infant mortality rate and low life expectancy. All these aspects lead then to higher unemployment in developing countries, and an overall lower standard of living. Furthermore, the existing assets in developing countries are often extremely unevenly distributed (Bundesministerium fur wirtschaftliche Zusammenarbeit und Entwicklung, 2018). In the study "World Economic Situation and Prospects" from 2018, the UN delineate trends to show various dimensions of the world economy.It was invented by Satoshi Nakamoto in 2008 when he has published his white paper "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008). Secondly, Ethereum is used as an example which is a blockchain-based, pub- lic, open-source, computing platform and operating system for smart con- tracts. This platform supports a modified version of Nakamoto's consensus mechanism and was proposed in 2014 by Vitalik Buterin (Buterin Vitalik, 2014; Rizzo et al., 2016). The underlying crypto currency is called "Ether".The Indonesian central bank has published a press released at the 13th of January 2018 that "forbids all payment system operator [...] in Indonesia [...] to process transactions using virtual currency" (Bank Indonesia, 2018, p. 1). This action shows that some states see crypto currencies as a real threat, which outweighs the advantages crypto currencies provide for those countries. 4 Developing countries and poverty The following section provides a definition of ,,developing countries".There is great potential to further strengthen the development of developing countries with the help of crypto currencies for example, by reducing corruption through enforcing social trust or by increasing financial inclusion of the population (Rothstein & Uslaner, 2005).Another aspect of crypto currencies is that they support financial inclusion because they do not require high technological standards besides having access to the internet and a digital device (for example a smartphone) to en- gage in transactions (Dow Jones Institutional News, 2018).Opportunities through crypto currencies in developing countries Based on the analysis of the economic problems in developing countries, crypto currencies can accelerate the development process potentially in vari- ous fields.7 Figure 1: Internet user penetration rate of population in 2017 and 2025, by region Note: Source: APAC - Asia Pacific; CIS - Commonwealth of Independent States, MENA - Middle East and North Africa; * - Forecast GSMA Intelligence data (2017).Contrary to a bank account user, they do not have to get through a "Know Your Customer" (KYC) process, where the user must identify himself, to have access to the Bitcoin market. Moreover, the decentralization and "the lack of flexibility in the Bitcoin supply schedule results in high price volatility" (Iwamura, Kitamura, Matsumoto, & Saito, 2014, p. 1).Additionally, they cannot exploit potential complementarities between innovation and export activities, which further increases the productivity gap (Gorodnichenko & Schnitzer, 2013).Thus, firms in developing countries are not able to generate as much revenue and profit as desired and therefore, support the local economy less through fewer jobs, lower salaries and an over- all lower tax volume.Another way of how crypto currencies could help to increase financial inclu- sion in developing countries is by serving as a quasi-bank account, since eve- rybody with internet access can download a Bitcoin wallet (Honohan, 2008).2 General advantages and disadvantages of crypto currencies This section presents the main advantages and disadvantages of crypto currencies compared tocentral bank-issued fiat currencies and discusses how they emerge from the underlying technology.The first advantage is that crypto currencies combine important properties to foster trust, such as accountability and transparency, which allows trust free interactions between counterparties.The underlying blockchain technology uses consensus mechanisms, hash functions and public and private key encryption to control transactions, which leads to the fact that the user does not have to trust the counterparty.For central bank-issued currencies, trust is established by third parties like intermediaries, and in almost every digital transaction in a fiat currency, an agent is employed to oversee the exchange.As previously shown, crypto currencies can lower the transaction time and costs significantly and can act as a type of bank account that allows people to make savings and conduct daily transactions (Honohan, 2008; Scott, 2016).Therefore, Bitcoin can be used to provide low-cost money transfers, particu- larly for those seeking to transfer small amounts of money internationally, such as remittance payments (Scott, 2016).For this reason, it is good and necessary that the usage of the internet in developing countries has increased dramatically over the past decade (Aker & Mbiti, 2010; Tapscott & Tapscott, 2016).To create a liquid market for Bitcoins some start-ups have been founded, such as BitPesa in Kenya, which provide liquid markets for some specific currency corridors, e.g. for the direct exchange of Kenyan Shilling to US dollar.The experts also differ significantly with regard to the region they live and work in, from Argentina, Kenya, Switzerland to Singapore.An overview of the involved experts can be found in Appendix B. Crypto currencies and local fiat currencies Regardless of the form, money must fulfil three main functions.The price volatility can be reduced due to the fact that only through centralization and support 11 by economic policy decisions crypto currencies can grow substantially (Aisen & Veiga, 2006).To get political support, crypto currencies need to be limited by national boundaries, so that the governments can control the economic parameters to keep monetary sovereignty (Expert 6, 2018).Based on the interviews, it can be assumed that crypto currencies are cur- rently no complete substitution for fiat currencies and add only a few addi- tions to fiat currencies.Improvement of financial inclusion in developing countries The improvement of financial inclusion is the most significant and most developed benefit of crypto currencies for the population in developing countries (Darlington, 2014).This paper examines the impact of crypto currencies on individuals and busi- nesses within developing countries.The intention is to show deci- sion-makers the possibilities to use crypto currencies to decrease developmental barriers.Transactions conducted by inter- mediaries do not only take time, but they also result in a risk premium for the user due to higher transaction costs (Pilkington, 2016).This money can often be transferred cheaper than with central bank-issued currencies, because using crypto currencies allows worldwide financial transfer without the need of an intermediary institution.Furthermore, no government or central bank can influence the supply of crypto currencies, because the supply is defined in the underlying protocol of the crypto currency (Nakamoto, 2008).A complete list of all countries the UN and this study considers as developing countries alongside with their geographical classification can be found in Appendix A. In the following, the main economic issues of developing countries will be explained.In addition, crypto currencies, predominantly in combination with smart contracts, can contribute to strengthening social trust and fighting corruption through a more transparent contract system.The participating experts vary widely with respect to their background knowledge from a Fintech start-up representative, a lecturer, to a consultancy ambassador.The fact, that crypto currencies are highly divisible and globally transferable leads to the conclusion that crypto currencies are highly suitable for the role as amedium of exchange (Ammous, 2018).A solution to keep the financial sovereignty alongside with crypto currencies is to issue a central bank-issued digital currency (Lagarde, 2018).One difficulty is that crypto currencies are not widely accepted and therefore have to be exchanged to the local fiat currencies, that their value can be used to purchase real-world items (Expert 5, 2018; Expert 1, 2018).Furthermore, a comparison with existing solutions is provided to show the practical relevance of crypto currencies.Due to the loss of power for the government and the risk of terror financing some countries have prohibited the use of crypto currencies, for example, Indonesia.A developing country is a country with a low Human Development Index and a less developed industrial base relative to other countries (O'Sullivan & Sheffrin, 2003).Furthermore, firms could be forced to a suboptimal behavior, if financial frictions are severe (Gorodnichenko & Schnitzer, 2013).Due to the detrimental situation of the companies, when they do not have access to financial intermediaries, they cannot get funding for innovation leading to competitive disadvantages compared to companies abroad.As social trust is highly correlated with equality, economic equality and equality of opportunities, social trust is inferior in most of the developing countries.In some cases, corruption can even outweigh the benefits of redistribution programs, such as Olken (2006) has shown for Indonesia.In general, new technologies and innovations are key solutions for the catch-up process of developing countries as Chudnovsky and Lopez (2006) have pointed out.Without crypto currencies the local fiat currency must often be exchanged to more wide-spread fiat currencies like the US dollar or the Euro and then must be converted again into the target currency, since there is often no liquid market for the exchange of the fiat currency to the target fiat currency.Using Bitcoins enables these parties to sell products in exchange for Bitcoin and thereby avoiding traditional e-commerce systems (Scott, 2016), which often involve having to set up a merchant account with a formal bank.Using crypto currencies enables individuals in more developed countries to make small money transfers to people in developing countries.Such microfinance transactions are currently expensive because the borrowing and the repaying transactions, face transaction fees that are almost as high as the payment itself.However, when transaction costs are massively reduced or are even eliminated, such loans could become more widespread (Ammous, 2015).The most significant difference between fiat currencies and crypto currencies is that fiat money is controlled by the central bank and therefore fully centralized, contrary to the decentralized organization of crypto currencies.To achieve a more stable price level and lower fluctuations, many crypto currencies progress in the direction of a more formally regulated currency (Expert 5, 2018).Moreover, there is a trend of many crypto currencies to change from a total decentralized system to a more centralized system, in which some actors have the decision power to increase the development possibilities (Expert 5, 2018).Furthermore, this has led some national authorities to characterize crypto currencies as a digital asset rather than a currency.Hence, crypto currencies are not restricted to a specific geographic area and can be traded around the world.One characteristic is that it makes it easy to transfer money from illegal activities or to finance terror activities 3 without the possibility of government intervention (Fernholz, 2015).The study classifies all countries in the world into one of three broad categories: developed economies, economies in transition and developing economies.The composition of these groupings is intended to reflect the economic conditions in these countries (United Nations, 2018).For example, Honohan (2018) observed in his study, that poverty is linked to access to financial services, and that limited access to financial services is a significant problem itself.Financial intermediaries are not only crucial for individuals but also for companies (Gorodnichenko & Schnitzer, 2013), because they provide jobs and can grant loans.Another problem in developing countries is a low level of social trust, because social trust tends to improve economic growth and the standard of living (Barham, 1995).Corruption tends to lead to a welfare loss as only a small group of people benefits from bribes, and many people suffer from the consequences of lower government income.The growth rate is especially high in areas with more developing countries like in the Sub-Sa- haran Africa region with a growth rate of over 90%.Crypto currencies like Bitcoin could help individuals and businesses to facilitate small-scale 8 international trade.Citizens can use the publicly available record data of the crypto currencies in the blockchain to monitor the way in which the state funds are used.It would also allow governments to track their spending better and to improve their budget allocation (Schmidt Kai Uwe, 2017).In Figure 2, crypto currencies are compared with with gold, the oldest form of money, and with central bank-issued fiat currencies with regard to different traits of money.The advantage of gold is that it is the best collateralized form of money because the exchange medium already carries value in contrast to banknotes or digital money.Many crypto currencies change from a decentralized system to a centralized system, even if this change results in the decline of the main benefit, the complete uncontrolled financial freedom of crypto currencies (Expert 7, 2018).This would result in a centralized system with governmental control, which diminishes many advantages of crypto currencies.Moreover, crypto currencies can allow people and firms to utilize technologies and increase the speed of development (Expert 3, 2018).Examples of such limitations are illiteracy, financial illiteracy, unstable political situations, unstable job markets and price volatility (Expert 7, 2018).In contrast, to traditional money transfers, the user in the Bitcoin system is pseudonymous.This high price volatility does not only holds for Bitcoin but for most of the crypto currencies, which makes it hard to store money and to make contracts in crypto currencies (Lo, 2014).Moreover, it also gives an overview about which countries are classified as developing countries and are therefore in the focus of this study.However, many countries cannot be placed entirely in one single category, because they often have characteristics that could place them in various categories.One reason for poverty is the limited access to 5 financial services (Beck& Demirguc-Kunt, 2006).Firms without bank accounts are excluded from a wide range of international services and are hindered in selling products outside their region (Scott, 2016).However, public policies 6 that could remedy this situation cannot be defined because there is a lack of trust

(Rothstein & Uslaner, 2005).This process could be optimized through crypto currencies, which could make it faster and cheaper (Ammous, 2015).For example, a Chicago-based Indian worker could use a local service provider that transfers US dollars to Bitcoins to transfer money to a family member in India, where the family can then deduct Rupees at a local service provider, which changes Bitcoins to Rupees.The decrease in transaction costs could also increase the possibility for microcredits because currently, money transactions face high costs.Discussion Based on a literature analysis, the following part of this paper consists of a qualitative analysis based on expert interviews.The interview partners have 9 been selected via the social networks Xing and LinkedIn.For crypto currencies the decentralization and the lack of collateral leads to the high level of price volatility.