A Two-Staged SEM-AHP Technique for Understanding and Prioritizing Mobile Financial Services Perspective Adoption

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Abstract

The development of wireless and mobile technologies has offered a remarkable business opportunity for mobile financial services (MFS). This research focuses on predicting and prioritizing MFS perspective adoption through multi-dimensional consumers' trust and perceived risk factors concurrently, which concepts found scant in the literature. An integrated technique based on survey questionnaire was suggested whereby the theoretical model was tested employing structural equation modeling (SEM), and the SEM output generated were utilized as inputs for analytic hierarchy process (AHP) to rank MFS perspective. Several antecedents of trust and perceived risk were identified and confirmed. However, perceived time risk has no statistically significant influence on aggregate perceived risk. The findings indicated that dispositional trust and perceived privacy risk impact consumers more than do other precursors of trust and perceived risk respectively. Consumers rely on these two factors probably because they are quite related to consumer personality trait and relevant to services provided. Mobile money transfer is the preferable MFS perspective used in Togo followed by mobile payment, and mobile banking correspondingly based on AHP result. The outcomes underscore that MFS managers require adopting and build trust-risk base in strategically crucial information system when formulating strategies to attract the ever-larger consumer. This study as well offered an innovative new approach to comprehend MFS adoption perspective through the benchmark methodology provided.

Keywords: Mobile financial services adoption, SEM (Structural Equation Modeling), AHP (Analytic Hierarchy Process), Multi-analytic approach, Trust, Perceived risk, User behavior

1. Introduction

With the fast growth of Internet technology coupled with the increasing number of mobile phone users, online services have played an essential and pivotal role in the e-payment area which offers an online transaction platform to patronize many e-commerce applications such as mobile learning, and mobile entertainment services, mobile financial services (MFS). The experts of these two fields attempt implementing these technologies to ease quotidian affairs so that the various industries, services organization, and others centers become closer to the clients by mitigating expenses and free from time and space constraint. Various advantages are provided by mobile commerce applications such as faster transaction speed and lower management fees (Kalakota and Whinston, 1997) , the benefit based on invariably time and place via a mobile device are probably the most crucial (Coursaris and Hassanein, 2002) (Dahlberg et al., 2008).

Furthermore, the internet and its related technology like MFS continue to enable users with factors that support adoption such as convenience, a better acquaintance of the technology, more tech-savvy clients (Chowdhury and Ahmad, 2011) (Niels and Bruce, 2003). Besides, various researchers have shown that delaying in using technology had a negative influence per capita income, skills growth and efficiency in production (Jorgenson, 2001) (Ramayah, 2005). As a result, adoption of technology innovation supports the improvement of country's economy. A current report by Forrester in the USA anticipates m-payment to grasp $52B in 2015 and later $142B by the end of 2019 (Powell, 2016). From previous studies, Gartner Dataquest has recommended that the number of m-payment users would increase to 104 million by 2011.

However, despite the fact that MFS (mobile banking, mobile payment, mobile money transfer, and so on) provides many advantages, there are relatively a large group of customers who decline to adopt such services. For instance, m-payment systems acknowledge failure to meet this expectation and to generate noteworthy interest among most American and European companies (Bradford, 2002) (Shen, 2008). Similarly, incited towards the low usage and adoption of m-payment services worldwide, a report found that even till 2012 large consumer is effectively uncertain to m-payment systems adoption in most countries around the world (Jones, 2008). Another research on German consumers concluded that merely 12% use their mobile devices for banking or shopping (Tanner, 2008); likewise, only 1% rate of mobile banking adoption was found from Togolese consumers (Financial Afrik, 2015). E-money was projected to shift paper money and face-to-face financial transaction (Tobbin and Kuwornu, 2011). This hope still delaying to fully materialized so far. Adoption implies that someone does something inversely than what he/she had formerly such as purchasing/using a new product, gain and conduct a new behavior and so on (Rogers, 1995). Studies on mobile money transfer (MMT) remain at its evolving stages since (Jenkins, 2008) (Hughes, N., 2007).

To ascertaining the motive of averting from this technology, various investigations have been conducted in diverse means to test and validate the factors enlightening MFS adoption from various angles (Karnouskos, 2004) (Mallat, 2004). (Luarn and Lin, 2005) (Gbongli et al., 2016a). Hence, primary investigating on MFS coupled with its related technology have shown several types of trust and or risk concerns (R. C. Mayer et al., 1995) (D. Gefen et al., 2003) (Luo et al., 2010) (Shumaila et al., 2010). For instance, some mobile banking services users were confronted with security risks emerge on their financial information via their PIN code (Kuisma et al., 2007). Since MFS applications through the internet are conducted in an open environment, their usage is inevitably exposed to security and privacy risk (de Vivo et al., 1998). The lack of trust remains one of the most recurrently cited reasons for clients to be reluctant to mobile banking application (Lin, 2011) hence confidence in web becomes the matter of concern (McKnight, 2005). Trust is narrowly allied with the belief of perceived risk (R. Mayer et al., 1995) which might found to be the principal component influencing the technology adoption, consequently MFS technology in this perspective (Featherman and Pavlou, 2003) (D. Gefen et al., 2003).

Although the various facet of the trust and risk element are of importance (Gefen et al., 2008), very sparse literature found to assimilate the two concepts conjointly (P. Pavlou, 2003) (Luo et al., 2010). Additionally, consumer concerns regarding trust and the perceptions of the risks of adopting online services have been investigated by many scholars (Pavlou, 2001) (Cheung and Lee, 2006) (Zhou, 2011) (Littler and Melanthiou, 2006) (Yousafzai et al., 2003) , however, the trust and perceived risk variables have only been modeled as a single construct, which fails to reveal the real features of these variables and explain why consumers resist such mobile financial services. More important, the robust methodology that could support the decision makers and online consumers' decision process in the multidimensionality was lacking in the process. The matters then are how to meritoriously and efficiently procure an adequate level of online trust so that successful transactions can be achieved while e-market (MFS) having a competitive advantage (Wu et al., 2010). Question on adoption when analyzed further than merely consumer behavior in acceptance process, it embroils decision-making situation between alternatives for each of which is made of various vital facets, of which risk is one (Boksberger et al., 2007). Trust consideration also remains a crucial factor in a situation involving major decision-making (Luhmann, 1979) and novel technology (Fukuyama, 1995) as well. Fundamentally, several theories and techniques might require adjustment so far. Earlier investigations towards information technology (IT) mainly have motivated on technology adoption model coupled with a statistical technique such as structural equation modeling (SEM) or its associated application (Davis, 1986) (Venkatesh and Davis, 1996) (Shin, 2008) (Gbongli et al., 2017). Although SEM usage noticeably increased in the information system (IS), it remains a sophisticated tool if no adequate measurement is validated which probably might hinder theory development due to the relative superiority (J. Anderson and Gerbing, 1988). Furthermore, dealing with innovation implies dependency on expert and risk-based decision (Joe and John, 2009). Accordingly, due to the presence of the multiple contradictory criteria encompasses in the potential factors of MFS adoption concerns, it can be considered as complex mathematical analysis grounded on multiple criteria decision making (MCDM) method. One of the most used MCDM technique is analytic hierarchy process (AHP), a very efficient technique in solving complicated often irreversible decision based on the judgments of decision-makers and relative position of the alternative allied with the hierarchical structure (Saaty, 1977) (Grandzol, 2005) (Gbongli et al., 2016b) (Gbongli, 2016). A significant difficulty in using AHP to multi-objective questions is the hypothetically large number of paired comparisons required for decision makers (Olson, 1988). However, to reduce this comparison alongside when testing the influential factors statistically, current researchers start to adopt the integrate SEM-AHP in supplier selection (Punniyamoorty et al., 2012), in Leanness evaluation (Ravikumar et al., 2013). Towards these ends allied with the momentous lower adoption rate of MFS noted alongside with the limitations in the previous theories so far, notwithstanding the enormous advantage which MFS offers, calls for a more in-depth analysis of the acceptance associated with MFS. Hitherto and to the best of our awareness, no research focus on the issues of MFS (Mobile Banking, Mobile Payment, and Mobile Money Transfer) adoption via factor multi-dimensionality with the decision theories.

Our research, with regard to these limitations, is predicated on understanding MFS adoption in Togo and (1) mainly pursues to grasp the determinant of their slow penetration rate via the various multidimensional trust and multi-aspect of risk while (2) ranking MFS alternative using SEM-AHP methodology. The aims remain to recommend a possible solution that could promote trust multidimensionality and alleviate these multifaceted risks in the adoption process. Thus, understanding the causes for these resistances would be beneficial for bank, and non-bank managers in formulating strategies intended at increasing mobile financial services use

## 2. Theoretical Background and Research Model

Individual's espousal for any technology is a product of multiple inputs from a varied background of factors such as social and psychological state (Sharma et al., 2016). Therefore, edge for any technology-driven initiative business relies generally on critical understanding and empirical results of technology adoption drivers among

the target folks. Furthermore, prior research revealed the complexity involve in persuading consumer at the individual level to adopt technology than organization employee (Heijden, 2004).

There are a plethora of technologies adoption models used on consumer behaviors towards IT till (Safeena et al., 2013). However, the majority of these theories such as the Theory of Planned Behavior (TPB) (Ajzen, 1985), Technology Acceptance Model (TAM) (Davis et al., 1989) and Diffusion of Innovation (DOI) (Rogers, 1962) have received incessant critical review throughout. Among these theories and models, TAM is extensively employed (Sharma et al., 2016). TAM has a unique advantage while using it for behavioral clarification towards a community. Even though the above models enlightening e-service or MFS acceptance behavior framework, they are not sufficiently robust when analyzing all the aspect consumers apparently intent across all the decision-making process, and hence (El-Kasheir et al., 2009) necessitate for integration. Moreover, a number of these theories and models were built and applied in developed nations, equally, their general inclination in the emerging countries like Togo might subject to misperception.

From this perspective, the finding of George (2004) after revising earlier information acceptance model concluded that trust consideration amongst the practitioner could be a critical laudatory and backup for an online vendor. Towards the dyadic review of trust as a psychological state, various trust types occur and the essence of trust as such changes over time (Lewicki et al., 2006) when positive experiences, expanded information, and predictability stimulate trust to the higher dimension. What makes trust commonly challenging to investigate is that it embroils three constituents (i.e., I trust you to do X) (Hardin, 2003). Rousseau et al. (1998) stress that trust is a psychological state which depends on the positive belief of intentions of a person to the other. Furthermore, one of the conditions that delineate trust is the risk, so in the absence of any risk, the necessity for trust would not ascend (Lewis and Weigert, 1985) (Schlenker et al., 1973). Risk as consumers' perceived risk denotes consumer's belief concerning likely uncertain undesirable consequence from the online transaction (Kim et al., 2008). Notwithstanding there have been significant pockets of studies and theory towards matters of trust and/or risk perception of technology adoption, relatively little is known concerning how and why multidimensional trust and multifaceted perceived risk concurrently could affect MFS adoption and perspective selection when decision-making issues arise. The research work of Xin et al. (2010) Luo et al., (2010) has stressed that multidimensional trust and multi-faceted perceived risk are so crucial in the acceptance of mobile banking. For marketing scholars, consideration of perceived risk on the multidimensional aspect contributes to obtaining the complete understanding of their effect (Cox, 1967) (Stone and Grønhaug, 1993) (Featherman and Pavlou, 2003).

With regard towards the above discussions, this study emphasizes on trust and risk dimensionality literature as explanatory and predictive variables headed for accepting and using MFS (mobile banking, mobile payment, and mobile money transfer) whereas prioritizing their perspective. Deriving from the existing studies, moreover, as each of the proposed traditional frameworks unveiled some drawbacks, the integrated model is assumed to offer a more transparent clarification on the MFS adoption in Togo which presently at the nascent embryonic level (see Fig.1).
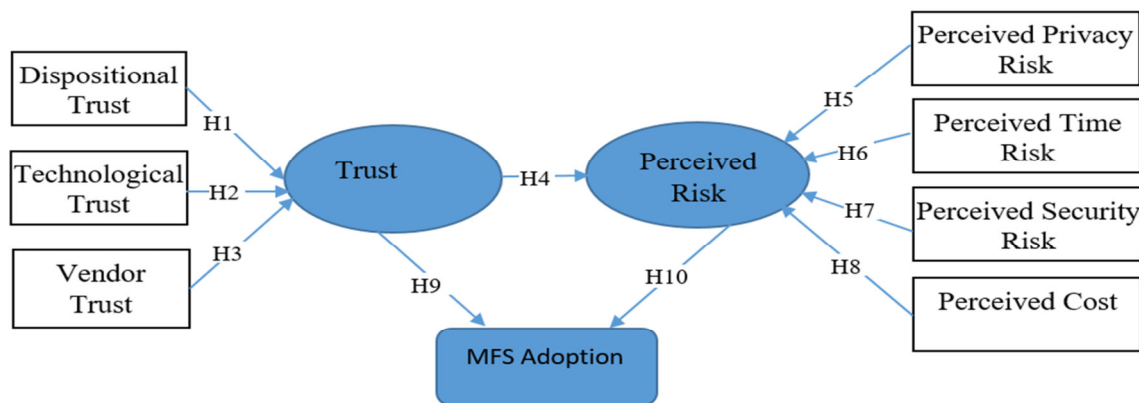
 Fig. 1. Proposed conceptual Model

3. Identified Factors (Criteria and Sub-Criteria) of MFS Perspective Acceptance
3.1 Hypotheses regarding dispositional trust/technological trust/vendor trust
Due to the intrinsic nature of online purchasing, consumers will always beseech some level of trust (McKnight et al., 2002) because risk could be present at any time (R. C. Mayer et al., 1995). Online purchasing trust reflects the readiness of one of the parties (the buyer) to be susceptible to the actions of a virtual establishment with the hope that this virtual establishment will perform a vital action or required task for the customer or purchaser, despite his or her ability to either perform or control the virtual establishment (Van Der Heijden et al., 2003). The idea of trust expresses a sundry multi-dimensional and context-dependent configuration (Gefen and Straub,

2003). Allowing for the involvedness and the multidimensionality of the notion (Hassanein and Head, 2007), one can make numerous and different delineations of trust in related literature. From the earlier research views towards the precondition to study the compelling feature of trust (Gefen et al., 2008), this study envisages to integrate dispositional trust, technology trust, and vendor trust as the determinant of trust construct. Since trust is continually grounded on at least one quality or feature of a trustee (Hoff and Bashir, 2015); therefore, Rotter (1967) began to consider trust as a disposition about the world and the people in it. This definition has then settled to be more content- and situation-specific. Numerous research in the past demonstrated that disposition to trust has an evident and direct effect on the growth of trust (Gefen, 2000) (R. C. Mayer et al., 1995) (Wang et al., 2015).

Towards technology and vendor trust, studies discovered that trust in mobile commerce could be considered from two perspectives such as trust in mobile technology and trust in mobile providers (Siau et al., 2001). Trust in online business includes the concept of technology trust, which reflects the subjective likelihood by which companies consider that the core technology infrastructure can ease transaction per their confident anticipations (Ratnasingam and Pavlou, 2002). Equally, technology trust connotes the readiness of someone, or individuals technological confidence to achieve a designated duty by the positive characteristic involved in the technology (Mcknight et al., 2011). Therefore, it is referred to the role of technology in creating a trusting relationship with the consumer (Misiolek et al., 2002). The dynamic landscape of the e-services architecture offers novels prospects for technology trust development (Ratnasingam and Pavlou, 2002). From this end, when consumers believe the technology used to be reliable, the probability to gauge the whole services more favorable and trustworthy will be improved.

For vendor Trust, it is considered as the degree to which the buyer perceives and depend on the seller that, he/she will carry out the promised transactional requirements in risky circumstances (Bailey et al., 2002). Merely put, trust can refer to an expectancy that others will not act opportunistically (David Gefen et al., 2003) and that the seller will offer what has been covenanted (Ganesan, 1994). In this view of the definition, the trust a consumer has in the vendor or company likely to influence his general trust. A research study was done (Pavlou et al., 2007) has acknowledged the negative relationship between online seller's opportunism. Grounded on the above discussion, we postulate:

H1: Consumer dispositional Trust has a positive and significant relationship with trust of MFS adoption

H2: Technological Trust has a positive and significant relationship with trust of MFS adoption

H3: Vendor Trust has a positive and significant relationship with trust of MFS adoption.

3.2 Hypotheses about trust, perceived privacy/ perceived time/ perceived security risk, perceived cost

With the increasing application of internet and wireless communication coupled with e-business, consumers are now active users; firms are gathering more customer information than ever before (Malhotra and Kubowicz Malhotra, 2011). However, online marketing transactions require online customer trust unobstructed for consumers to submit an online order and just place his/her financial info and further private data in performing other monetary transactions (Yazdanifard et al., 2011).

Towards the relationship between trust and perceived risk, studies revealed that inclination to risk-taking is a common characteristic of all trust environments (Costigan et al., 1998) (Johnson-George and Swap, 1982). Accordingly, consumer trust might be subjected to the degree of the intricate risk engaged in the circumstances (Koller, 1988). Online trust can lessen the level of perceived risk allied with transaction processes (P. Pavlou, 2003) (Koufaris and Hampton-Sosa, 2004). Many are those researchers (Gefen and Pavlou, 2006) (Mukherjee and Nath, 2007) (Chen and Barnes, 2007) who stressed that perception of risk in e-market could be mitigated by the online trust since risk perception is a strong trust antecedent. Understanding study focus on the trust-risk relational concept (D. Gefen et al., 2003) is of paramount importance, only very scant theoretical and empirical support have found in MFS fields (Gbongli et al., 2017).

In an online situation, we are interested in subjective (perceived) risk and not necessarily physical or real world (objective) risk (Mitchell and Nygaard, 1999) which is consumer's subjective anticipation of loss (Sweeney et al., 1999). Perceived risk has been regarded as the consumer's perceptions of the uncertainty and the probable detrimental outcomes of utilizing the system (Lee, 2009) (Harvey et al., 2007). For instance, people may feel a certain degree of risk when acquiring a product via a novel technology (mobile e- payment), since this procedure might increment the yoke/jeopardy, hence preventing consumers from online business involvement (Lee, 2009). Marketing researchers have encouraged the standing notion of the consumers' perceived risk in the multidimensional level pointedly in getting a complete understanding of their influence (Cox, 1967) (Roselius, 1971a) (Stone and Grønhaug, 1993) (Mitchell, 1999) (Featherman and Pavlou, 2003). The aggregate of consumers' risk perception depends on several variables, and consumers have many antidotes when the situation entails mitigating the amount of risk they perceive regarded product acquire online. Search action ascends purposively of decreasing the person's global perceived risk level (Dowling and Staelin, 1994). From the perceived risk theory (PRT) researchers' view, perceived risk are grouped in several dimensions. These

dimensions include performance, financial, social, psychological, security, privacy and physical risks (Kaplan et al., 1974) (Roselius, 1971b) (Featherman and Pavlou, 2003) (Jacoby and Kaplan, 1972) predominantly. Financial risk (Zielke and Dobbelstein, 2007) can be regarded as the probability of an economic loss during a wrong purchasing choice/decision. To put simply, the effect of price-quality relationship that consumers develop shows a dynamic role in perceived financial risk as a cost perception (Sweeney et al., 1999) (Liljander et al., 2009). For perceived cost risk, it is found to affect the adoption of mobile banking negatively (Bellman et al., 1999). According to Bellman et al. (1999), the perception of time risk is a significant predictor of online buying behavior. The study envisages that MFS users might be time-oriented users, therefore value their time spent to search for info, making a decision and financial transaction. Security/privacy risk has been linked to an inherent loss entirely to fraud or hacktivist haggling the security of end-user during online service (Lee, 2008). For that reason, security in online perspective discloses consumers' perception regarding the security both of e-transaction and the protection of financial data along with the transaction from unauthorized (Limbu et al., 2011). For instance, consumers were an unwillingness to complete a merely online purchase mostly because of risk issues, and this sets perceived risk as a noticeable barrier (Lee, 2009). The above discussion led to the following hypothesis.

H4: consumer's trust has a significant and negative association with perceived risk of MFS.

H5. Perceived privacy risk has a significant and negative association with aggregate perceived risk of MFS.

H6. Perceived time risk has a significant and negative association with aggregate perceived risk of MFS.

H7. Perceived security risk has a significant and negative association with aggregate perceived risk of MFS.

H8. Perceived Cost has a significant and negative association with aggregate perceived risk of MFS.

3.3 Hypotheses related to consumer trust, consumer risk perception

The shift from traditional purchasing behavior to virtual ones remains not always as easy as one would imagine. Difficulties in accepting MFS systems arise even with very well educated people who are assumed to be among the initial adopters of all novel technology. Thus researching trust and perceived risk towards MFS adoption is beneficial when assessing issues of acceptance and usage along with decision-making process.

Since risk is ever-present, trust becomes an essential element to be considered as well (McKnight et al., 2002). Correspondingly to every other business transactions, MFS (mobile banking, mobile payment, mobile money transfer) context require a component of trust (Iftekhar et al., 2015). Similarly, with online transactions, MFS encounter considerable uncertainty and risk, which therefore require online customer trust (Yazdanifard et al., 2011). There is much research that sustained the negative influence the perception of risk has on online usage and purchasing behavior (Liang and Huang, 1998) (Liao and Cheung, 2001) (Kim et al., 2008) (P. A. Pavlou, 2003). A study revealed consumer behavior was profoundly influenced by the risk observed or perceived, and thus they are recurrently uncertain regarding the consequences of the choice or an action (R A Bauer, 1960). Consumers try to reduce risk rather than optimize utility when it comes to their subjective risk which in turns soundly govern their behavior (Mitchell and Nygaard, 1999). Whereas risk often remains inevitable in transactions, consumers attempt to lessen risk by enlightening themselves before procuring goods and services. Empirical evidence indicated that most individuals are risk averse (Binswanger, 1980) (Lin et al., 1974). A perceived risk has been found to influence online consumer decisions making (Antony et al., 2006). On the same logic, earlier research indicates that the more is the consumer's perception of risk in buying context, the less probable he/she will be devoted to buying (Dowling and Staelin, 1994). With the support of the existing literature from above review, it can be postulated that:

H9: Consumer trust has a positive and significant relationship with MFS adoption.

H10: Consumer risk perception has a negative and significant relationship with MFS adoption

4 Methodology

4.1 Design and Data Collection

To test our research model, we involved in an empirical study employing data from the self-survey questionnaire made mainly based on the objective of the research purpose. SEM-AHP technique necessitates two types of questionnaires designed to meet the standard of each technique: Likert scale questionnaire and Saaty scale questionnaire.

Questionnaires using a 5-point Likert scale with the anchors of strongly disagree (1) to strongly agree (5) can support diminishing variability in the output. The survey instruments were either adopted or adapted from a wide-ranging literature review (Gefen and Straub, 2003) (Wang et al., 2015) (Luo et al., 2010) (P. A. Pavlou, 2003) (Featherman and Pavlou, 2003) purposely to check content validity, added to the items envisioned to collect the demographics of participants. The draft of the questionnaire was generated in the English language then converted into French (the official language of Togo) for its assessment. The collected data were acquired from the populace of Lomé (Capital town of Togo) particularly the segment of the city where the sampling could provide a representative data or having a pertinent data. To mitigate the probability that participants partook in

the survey more than once, each participant was asked to provide his/her mobile phone number in the survey. Later, identical mobile phone numbers were employed to refine out multiple answers from the same participants. Users were free to cooperate at their own preference. This field survey, which generated 584 responses, was led for almost three months, with partial responses and missing values removed, ensuing in a sample size of 538 users for a global response rate of 92.12 percent. 54.6% of the respondents were male, and 45.4% were female. The majority of respondents (37%) were within 25-30 age group. 65.2% respondents have at least experienced MFS. Finally, the education level of the shown that almost half of the participants (50.4%) got Bachelor degree and above whereas the remaining (49.6%) have Baccalaureate or even are unschooled.

Regarding AHP procedure, a questionnaire (Saaty scale) using a scale of absolute judgments that characterize, how much more, one element prevail on another vis-à-vis a given attribute was required for the pairwise comparisons of alternatives, to achieve the weights and later prioritize the alternatives. The developed questionnaires are delivered to experts, and MFS experienced users. 52 of distributed 93 questionnaires are answered, and 47 of those 52 obtain an adequate consistency test. As such, these 47 proper questionnaires are used to generate the weights of alternatives. More detail on AHP method is booked under next section.

4.2 Rationale for SEM-AHP Data Analysis Technique

The research analysis expects to use the combined methodology SEM-AHP in assessing and prioritizing the various indicator of MFS perspective adoption.

Along with this process, SEM application is needed purposely in checking a causative relations between predictors and adoption behavior (Schumacher and Lomax, 1996) (Hair et al., 2006). Being a standard statistical approach that subsumes and extends regression, correlation, factor analysis and path analysis (Schumacher and Lomax, 1996), SEM embodies a pivotal advancement in social work study(Hair et al., 2010). SEM remains emphasized on testing causal processes and hypotheses inherent in our theories as well as extending theory development (J. C. Anderson and Gerbing, 1988). The supported relationship in SEM and the significant variables (sub-factors/sub-criteria) will be then employed as input to AHP.

Contrariwise, AHP will be beneficial in sorting the perspective of MFS. The core benefit of merging these two techniques is that a novel approach for evaluating and ranking MFS perspective adoption whereby the advantage of one approach will be utilized to offset the drawbacks of the other technique. The Analytic Hierarchy Process (AHP) is a multi-criteria decision-making approach initiated and presented by Saaty (1977, 1980, 1994) considered as one of the important approaches to estimate the finite number of alternatives for MCDM problem-solver. The AHP has enticed the interest of many scholars due predominantly to the useful mathematical properties of the technique (Triantaphyllou and Mann, 1995). One of the utmost widely acknowledged and employed multi-criteria analysis approaches, the AHP method allow users to compute the parameters weightage in the result of a multi-criteria problem. On the prime phase, a hierarchy containing the decision elements that remains built grounded on the problem. At least, three level of the hierarchy could be employed such as the general objective of the problems put at the top; multiple criteria that enlighten the alternatives in the central part; and the decision alternatives at the bottoms (Albayrak and Erensal, 2004) (Saaty, 1990).Once the problem is set in a hierarchical structure, the weights of the criteria creating the hierarchy are computed. To evaluate the criteria involved in a level associated with other criteria/sub-criteria incorporated in the ensuing hierarchy level, scoring is made with the use of the preference scale recommended by Saaty (1980), given the possibility of building a pairwise comparison matrix (Saaty, 1980) (Saaty, 2004). The pairwise comparison matrix entails of $n(n-1)/2$ comparisons for n number of elements (Lee et al., 2012) (Malczewski, 1999) based on the decision maker's views for every pair of criteria and alternatives (perspectives) separately. But, the relative weightage of sub-criteria is achieved through SEM result. Using weights or priorities grounded in the pairwise comparison support in elucidating issues using AHP. Therefore, weights or priorities are calculated through a normalization of the pairwise comparison matrix. Moreover, whereas conducting pairwise comparisons of criteria in the AHP method, a certain level of inconsistency might transpire. As such, the rational consistency of pairwise comparisons must be tested. To gauge the consistency of pairwise comparison resolutions, the consistency ratio suggested by Saaty (1980) is adopted. However, a consistency index (CI) displayed in equation (1), and the average value of CI represented as RI with random matrices employing the Saaty scale (See table 1) were utilized in calculating the CR in equation 2.

$$CI = (\lambda max - n)/(n - 1) \tag{1}$$

$$CR = CI/RI \tag{2}$$

Table 1.The value of RI

Dimension (n)	1	2	3	4	5	6	7	8	9	10
(Random Index) RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

(Remark: n is the number of factors)

The ratio of 0.10 recommended by Saaty as the upper limit was used as a reference. In a situation where the

consistency ratio computed for the judgments remains under 0.10, it is reflected that the judgments display a sufficient degree of consistency and that the evaluation can be continued. If a higher consistency ratio (CR) is found, then the judgment is considered inconsistent. In this situation, the quality of the judgment required to be improved. The consistency rate can be diminished by revising the judgments. Moreover, *CR* can also be applied to assess both the consistency of decision makers and all the hierarchy (Wang and Yang, 2007).

While the individual AHP questionnaire was revised for consistency test, there is need to calculate the aggregation weights of each alternative via the comparison matrix to classify the best alternative. From this end, the geometric means was adopted as being the most widely accepted formulae employed (Davies, 1994) considered in the following form:

$$W_i = \left(\Pi_{j=1}^n a_{ij}\right)^{1/n} \qquad (3)$$

Where a_{ij} denotes the pairwise comparison score in each alternative connected to sub-criteria, and W_i embodies the relative weights of the alternative. Geometric outcome will back up the classification of MFS alternative (mobile banking, mobile payment and mobile money transfer). Hence, the decisive weight of each alternative can be assessed utilizing the following formulae, if we assume that MFS_i is one of the alternatives.

$$MFS_i = \sum_{j=1}^m A_i b_{ij} \qquad (4)$$

b_{ij} : Relative weightage for alternatives i in relation to j^{th} sub-criterion of the model.

A_i : Relative weightage for the sub-criterion j.

5 Results and Discussions
5.1 Measurement Assessment
After determining the internal consistency (reliability) statistics by Cronbach's alpha and composite reliability and further to ensure convergent and discriminant validity (see Table 2), the confirmatory factor analysis (CFA) was conducted. All Cronbach's Alpha and composite reliability have gained values exceeded the threshold level of 0.7 (Fornell and Larcker, 1981) expressing good reliability. Moreover, the average variance extracted (AVE), are ranged from 0.571 to 0.779, i.e., above the recommended value of 0.5 (Yoo and Alavi, 2001) which indicate good convergent validity. Discriminant validity can be determined by assessing whether the correlations between the variables are less than the square root of the average variance extracted (AVE). Table 2 portrays all the square roots of each AVE value to be higher than the off-diagonal elements. This is to confirm discriminant validity among variables.

Table 2.Reliability and validity of the construct

	CR	AVE	MSV	MaxR (H)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	.846	.647	.227	.848	**.804**									
(2)	.933	.779	.133	.965	.108	**.883**								
(3)	.904	.704	.087	.975	.216	.067	**.839**							
(4)	.86	.609	.057	.979	.168	.157	.155	**.78**						
(5)	.855	.664	.227	.981	.476	.02	.23	.144	**.815**					
(6)	.843	.577	.056	.984	.236	.061	.114	.011	.235	**.76**				
(7)	.856	.6	.133	.985	.041	.365	.044	.238	-.022	-.072	**.775**			
(8)	.811	.594	.065	.987	.127	.155	.113	.232	.091	.035	.255	**.771**		
(9)	.798	.571	.013	.987	.102	.098	.065	-.004	-.035	.086	.075	.115	**.756**	
(10)	.82	.61	.087	.988	.228	.051	.295	.064	.198	.216	-.042	.019	.104	**.781**

Note: CR, composite reliability; AVE, average variance extracted; MSV, maximum shared squared variance; Coefficient H (is a function of squared standardized loading)
Note: Diagonal elements are the square root of average variance extracted. These values must surpass the inter-construct correlations for sufficient discriminant validity
Note: (1): DT-Dispositional Trust; (2): PPR-Perceived Privacy Risk; (3): VT-Vendor Trust; (4): PC-Perceived Cost; (5): MFS Adoption-MFSAd; (6): TT-Technological Trust; (7): PR-Perceived Risk; (8): PSR-Perceived Security Risk; (9): PTR-Perceived Time Risk; (10): Trust-TRUST

5.2 Structural Model Assessment
The analysis of the structural model encompasses estimating of path coefficients. We evaluated the overall goodness-of-fit employing the chi-square test. The chi-square test measures the adequacy of a hypothesized

model in relation to its ability to reveal variance and covariance of the data. Because of its propensity to be sensitive to sample size, other fit indices (e.g., GFI, AGFI, CFI, and NFI) were deliberated in combination with the chi-square. The output of structural equation modeling gained for the proposed conceptual model shown a ratio of chi-square to the degree of freedom (χ^2/df) of 2.152 , goodness-of-fit index (GFI) of 0.990, adjusted goodness-of-fit index (AGFI) of 0.949, comparative fit index (CFI) of 0.959, normed fit index (NFI) of 0.934, root mean square residual (RMS) of 0.016, and root mean square error of approximation (RMSEA) of 0.046 (see Fig. 2). Generally, fit statistics greater than or equal to 0.9 for GFI, NFI, RFI, and CFI indicate a good model fit (Bagozzi et al., 1991) (Hair et al., 1998). Value of RMS less than 0.08 is recommended by (Browne and Cudeck, 1993). Furthermore, RMSEA values less than 0.08 are considered acceptable (Hair et al., 1998); hence, all the indices suggested that our model fit was acceptable. Overall, the SEM model ensures that the proposed model is consistent and obtains adequate level (Table 3).

As portrayed in Figure 2, the effect of consumer dispositional trust (DT), technological trust (TT), and vendor trust (VT) on the trust construct (TRUST) has been confirmed by the H1-H3. Each of these hypothesis results is in-line respectively with previous works (Payne and Clark, 2003) (Liu et al., 2009) (Harrison McKnight et al., 2002) (Gbongli et al., 2017) in various online services. From this view, it is expected that people with high/low scores on the trust scale will display higher/lower level of online trust (Grabner‑Kräuter and Faullant, 2008) which in turn can increase MFS usage. Towards technological trust and vendor trust, the result ratifies the opinion that MFS acceptance necessitates the consumer to trust e-vendor offering the chosen technology in the form of services. Consequently, the paper admonished the providers MFS services such as banking and non-banking to develop an organization trust, in general, to change potential consumer from ambiguous thinking to one that will be ready the acceptance of MFS.

The hypothesized path from consumer trust (TRUST), perceived privacy risk (PPR), perceived security risk (PSR) and perceived cost (PC) on the aggregated perceived risk (PR) has been proved by H4, H5, H7, and H8. The result can resolve that perceived privacy risk H5 (β= 0.309, p < 0.001) is indeed the predominant perceived risk dimension in the view of the Togolese participants of MFS. It also highlights the fact that privacy issues, fraud, and identity theft are prominent in the minds of MFS consumers. Therefore, proposing privacy risk protection policy, encryption, and secure authentication to obviate fraud and identity theft must be a priority in this condition. The literature generally offers supporting studies on the significance of these relationships (Featherman and Pavlou, 2003), (P. a. Pavlou, 2003) (Muñoz-Leiva et al., 2017). Furthermore, Morgan and Hunt (1994) have supported the belief in which trust mitigate consumers' perceived risk. Most of the motivations that increase trust are similar to that mitigate perceived risk. However, H6 expressing the influence of Perceived time risk (PTR) on the aggregate perceived risk (PR) was not statistically significant. The result of H6 is in contradiction with a prior online research (Zhang et al., 2012) which has revealed a positive relationship between time risk and perceived risk. However, this present result support previous investigation on the prioritizing of SST in Togo which found that consideration of time risk as sub-criteria under perceived risk was trivial (Gbongli, 2016). It seems the survey respondents predominantly, and the Togolese consumers, in general, do not highly consider the time spent on the services (searching for info, time for the service performed).

Lastly, trust (TRUST), and perceived risk (PR) have a significant effect on the adoption of MFS (MFSAd) at the 0.01 level or lower. These findings patronize H9 and H10, therefore, sustained by empirical evidence from previous works. For instance, hypothesis result H9 is consistent with the study of E-commerce adoption for SMEs (Chakuthip et al., 2007), and moreover congruent with the concepts that trust in business is the essential and inherent incentive of behavior in general (Konovsky and Pugh, 1994) (Schurr and Ozanne, 1985) and the facilitator factors for MFS acceptance in particular. The practicability of this H10 result found support from the theory of consumer behavior (Raymond A Bauer, 1960) (Taylor, 1974) allied with risk perception. The high consideration of risks could enlighten the low rate of MFS acceptance especially mobile banking (presently, about 1% in Togo). The more people do not trust MFS such as mobile banking, the more they might develop a reticence toward it application (Zhou, 2012). Financial institutions particularly banking and non-banking providing MFS services should ensure security and trustworthiness guideline to their consumers (Al-Jabri and Sohail, 2012), so they can feel more confident to comprehend and espouse this new technology.
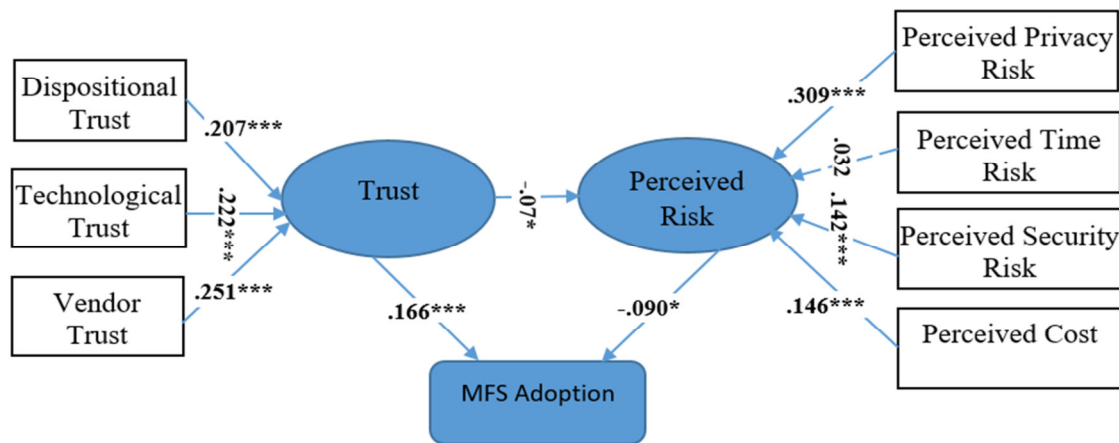
$x^2/df = 2.152$, GFI=0.990, AGFI=0.949, CFI=0.959, NFI=0.934, RMS =0.016, RMSEA=0.046

Note: — — — — ➝ dotted line represents no significance   * $p<0.05$; ** $p<0.01$; *** $p<0.001$ level of significant

Fig. 2. Final validated research model

Table 3. Fit indices of SEM

Indices	Suggested	Final structural model
Chi square (x^2)	Pval>0.05	34.426
Normed chi square ($x^2_{/DF}$)	1< x2/df< 3	2.152
Root mean square residual (RMS or RMR)	<0.08	0.016
Goodness-of-fit index (GFI)	>0.90	0.990
Adjusted GFI (AGFI)	>0.80	0.949
Normed fit index (NFI)	>0.90	0.934
Comparative fit index (CFI)	>0.93	0.959
Root mean square error of approximation (RMSEA)	≤ 0.08	0.046

Table 4. Result of hypothesis testing

Hypothesis	Causal path			Point Estimate	C.R.	P value	Remarks
H1	DTrust	➝	Trust	0.207	4.246	***	supported
H2	TTrust	➝	Trust	0.222	4.939	***	supported
H3	VTrust	➝	Trust	0.251	6.827	***	supported
H4	Trust	➝	PRisk	-0.070	-1.968	0.049	supported
H5	PPrivR	➝	PRisk	0.309	8.987	***	supported
H6	PTimeR	➝	PRisk	0.032	0.951	0.342	Not supported
H7	PSecurR	➝	PRisk	0.142	4.805	***	supported
H8	PCost	➝	PRisk	0.146	4.475	***	supported
H9	Trust	➝	AdMFS	0.166	2.615	***	supported
H10	PRisk	➝	AdMFS	-0.090	-2.416	0.043	supported

* p<0.05; ** p<0.01; *** p<0.001 level of significant

5.3 Computation of Relative Weightage of Sub-Criteria (Ai) via SEM

In this step, only the output of the variously supported antecedent of trust and antecedent of risk perception on trust and perceived risk construct respectively from SEM is considered for the relative weightage of the sub-criteria. According to the analysis of SEM, merely six sub-criteria are necessary for the assessment of alternatives. These relative weights are found out and concluded after their normalization in Table 5.

Table 5. Relative weightage of sub-criteria

Sub-criteria	(DT)	(TT)	(VT)	(PPR)	(PTR)	(PC)
Normalized relative weightage	0.1774	0.1902	0.2151	0.2648	0.0274	0.1251

5.4 Computation of Relative Weightage of MFS Alternatives in Relation to each Sub-Criteria (b$_{ij}$) via AHP

Determining the relative weightage of MFS alternatives in relation to each sub-criteria, both experts and MFS

experienced users are needed to be employed for the development of the pairwise comparison matrices as per Saaty' scale. The consistency index (CI) was computed where n is the order of matrix 3. Therefore, the value of RI (Table 1) for the corresponding n was found to be 0.58. It was discovered that the relative weightage values were consistent with CR, i.e., the ratio between CI and RI calculated from equation 2. Using the normalized geometric in equation 3 to estimate the eigenvector between three MFS alternatives and six sub-criteria, the relative weightage of MFS alternatives allied with each sub-criterion was computed (Table 6).
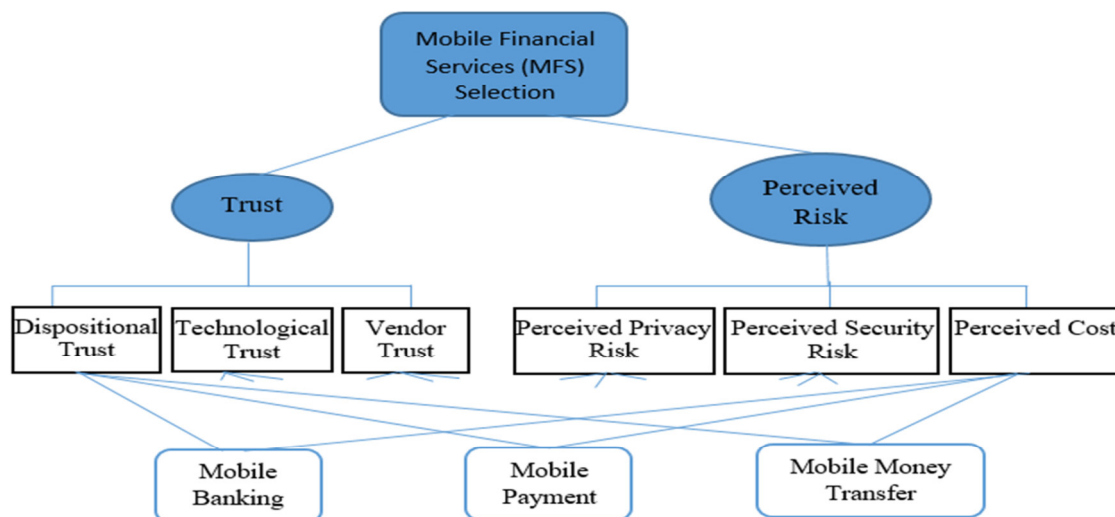
Fig. 3. A trust-risk based AHP framework for prioritizing MFS perspectives.

Table 6. Summary of relative weightage of alternative with respect to each sub-criteria

	(DT)	(TT)	(VT)	(PPR)	(PSR)	(PC)
Mobile Money Transfer (MMT)	0.712	0.719	0.656	0.613	0.559	0.183
Mobile Payment (MP)	0.208	0.211	0.257	0.305	0.335	0.111
Mobile Banking (MB)	0.079	0.069	0.086	0.075	0.104	0.704

Note CR=0.054, Lambda=3.052

5.5 Computation of MFS Alternatives.

Based on the hierarchical framework for MFS selection (see Figure 3) six variables (sub-criteria) showed to impact MFS choice and adoption. Therefore, the MFS formula in equation 4 which can be recorded in a more detail form (see equation 5) were used:

$$MFS_{i'} = A_1 b_{11} + A_2 b_{12} + A_3 b_{13} + A_4 b_{14} + A_5 b_{15} + A_6 b_{16} \qquad (5)$$

b_{16}: Relative weightage for alternatives 1 in relation to 6th sub-criterion of the model.
A_6: Relative weightage for the sub-criterion 6

The final MFS choice scores are computed by replacing their weightage in the directly above formula. Hence, Table 7 shows the ranking of each alternative of MFS.

Table 7. Synthesis with respect to choice of MFS

	MFS	Rank
Mobile Money Transfer (MMT)	0.6000 (60%)	1
Mobile Payment (MP)	0.2449 (24.49%)	2
Mobile Banking (MB)	0.1526 (15.26%)	3

Final weight of MMT= (0.1636*0.712) + (0.1708*0.719) + (0.1937*0.656) + (0.2443*0.613)
+ (0.1123*0.559) + (0.1154*0.183) =**0.6000**

The factors are grouped by criteria, sub-criteria and the alternatives are comprised of mobile banking (MB), mobile payment (MP) and mobile money transfer (MMT) (see Figure 3). The final AHP output after discussion with experts shown that MMT (60%) is the utmost desirable MFS adopted and used when there is a need for any MFS in Togo compared to MP (24.49%) and MB (15.26%). The probable reason for this high preference could be that users of MMT do not necessarily require having a banking account before using it in contrast to MB. Furthermore, those users might prefer conducting transfer money than using mobile as payments at the point of sales (POS) which center on mobile payment (MP).

6. Conclusion

With the goals of boosting allocate resources to attain productivity advantage, to efficiently satisfy mobile

financial services consumer's needs and wants, it becomes imperative to evaluate the factors allied with this service acceptance. Past researchers revealed and recognized the intrinsic risk involved in e-business buying decision, and thus consideration of trust remain pivotal to provide consumers the assurance needed for such transactions (Cho et al., 2002) (Gefen, 2002) (Urban et al., 2000).

The purpose of this research is to first assess the impact of trust-risk in the multifaceted level towards the adoption of MFS by proposing and validating a research model. Furthermore, this study is to develop a useful, representative, robust, and ample model for ranking MFS when multiple decision issues arise. According to Bilsel et al. (2006), rather than choosing a single decision maker, multiple decision-makers are regularly preferred to avert the bias and to mitigate the prejudice in the decision process; therefore, multiple decision-making approaches are used to reach this drive based on SEM-AHP technique. The SEM patronize testing of the causal relationship between the various factors, provide model generating, and offer weight for sub-criteria. Assessing of alternatives headed for sub-criteria is delivered via AHP which allows decision makers to acquire a complete ranking. The data support the final research model adequately (See Figure2) which in turns integrates almost all the proposed hypothesis. Towards MFS alternative, the ranking showed mobile money payment as the entire desirable MFS than mobile payment and at a lesser extent, mobile banking.

6. 1 Implications

The aspect of implication resulting from a study can open the door to future research in the field. This research has several implications.

Firstly, among the various factors introduced into the model, the dispositional trust effect on MFS adoption and the perceived privacy risk impact on the aggregate perceived relationship represent the two highest point estimate with pronounced significance relationship respectively. MFS companies' providers can use the outcomes from this study to improve MFS acceptance. Perceived time risk was not found to impact the aggregate perceived risk, as well as cost will not be a direct predictor of MFS adoption. Therefore, instead of pinpointing on price strategies and developing a faster application in time span, MFS should slightly converge on improving the security and privacy of MFS applications. For instance, these companies may encourage a privacy risk protection policy and grant technological sustenance and anti-fraud to ensure potential end-users towards the minimal security risk. These results are of paramount importance for MFS services providers to focus on formulating effective trust-risk based technique to retain the existing customer base. Based on AHP result towards MFS alternatives selection, companies providing mobile money transfer are advised to preserve the adoption incentives whereas those of mobile payment and mainly mobile banking require putting their consumers at the center of their business through diversification marketing strategy.

Secondly, the research has offered a multi-analytic methodology in the study of MFS adoption by incorporating SEM and AHP. The application of AHP being part of MCDM method addressed limitations of past research in two points (Kim, 2009) (Zhu et al., 2008) . Primarily, a model employed to test an adoption or performance study should have adequate reliability and validity, in case the data will be obtained through a questionnaire. Moreover, the full model that arises from decision-making method scant of indicating the correlation and causal relationship. Whereas, SEM is able to assess the causal relationships presented in the study. Conversely, SEM predictive power lacks the capability of the decision-making when multiple criteria issues arise and to rank alternatives. However, AHP is ascertained as a tool to offer a rational and realistic solution regarding the consumers' choice where the consistency ratio could be checked and adjusted throughout the assessment process. As stressed by Scott and Walczak (2009) adopting a multi-analytic approach revealed how merging two diverse data analysis techniques in either methodology or other analysis can enhance the validity and confidence in the output. For this research, the statistical significance generated from SEM is strengthened and provided weight for AHP sub-criteria while predicting MFS adoption. From these ends, the AHP technique confidently applied those factors in ranking the MFS alternatives. This hybrid method supports diminishing the subjective error during MFS evaluation.

6.2 Limitations and Future Study

Although useful implications are provided in various forms, all research inevitably encounters shortcoming that needs to be addressed. Firstly, the data was merely acquired from Togolese consumers. This restrains the generalization of the outcomes to other nations or localities. Future work might emphasize on performing a multi-country comparison study of MFS adoption. Secondly, the factors employed appears not to embody all the essential aspects. Therefore, future study can search for further variables (like network influence, usefulness, perceived ease of use, familiarity) that can upsurge the explanatory power to more accurately predict and assess MFS consumer's adoption behavior with their preference. The multi-analytical technique adopted shown in assisting as a benchmark for future MFS adoption research, and it conveyed a new insight on examining and prioritizing MFS adoption perspective for future study.

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