The Relationship between the Technology Readiness Index (Tri) and the Quality of Digital Services of Brazilian Financial Institutions

Carpeggiani Gomes Monteiro de Andrade[1], Marcia Juliana d'Angelo[2,]*

[1] MSc in Business Management at Fucape Business School, Brazil
[2] Associate Professor at Fucape Business School, Brazil

ABSTRACT

This study aims to identify the technological readiness variables associated with the quality perceived by customers who use digital services offered by banking institutions operating in Brazil. Descriptive quantitative research, in cross-section, with a sample of 958 clients of financial institutions operating in Brazil. The data were analysed using Structural Equation Modelling and multigroup analysis using SmartPLS. Given the growth of Fintech driven by disruptive technologies, traditional banking segments are looking for a competitive advantage to retain their customers. The findings showed that optimism and innovativeness have a positive influence on perceived quality. In contrast, discomfort with functional and physical risk, discomfort with embarrassment, and insecurity with information have a negative influence on perceived quality. Insecurity due to lack of contact does not influence the quality perceived by customers. There are also no differences regarding the gender and income of customers and the type of bank with whom they have a relationship, only in the group between public and private banks in the relationship between innovativeness and perceived quality. However, the explanatory power of the model indicates that other factors also impact this relationship. Although Fintech is growing at an accelerated pace, traditional bank customers seek other factors that impact perceived quality. In this way, it shows that traditional banks can consider other organisational actions to retain customers in addition to disruptive technologies.

Keywords: *Readiness for Technology, Perceived Quality, Financial Institutions*

Introduction

Given the speed, the ability to communicate, the ease of use, functionality, and connectivity, the impact of new technologies has revolutionised the way of life of people and companies (Parasuraman & Colby, 2015). In this sense, the provision of easy-to-use technological services

by organisations is characterised as a factor of competitive advantage in the search for customer loyalty (Grohmann, Radons, Battistella, & Anschau, 2014). This situation is the case with digital channels, developed to strengthen the relationship with customers (Pozza, Texier, & Najar, 2018; Sands, Ferraro, Campbell, & Pallant, 2016; Verhoef, Kannan, & Inman, 2015). Based on the banking sector, such technological advances have facilitated transactions carried out by customers, showing a new service model, banking self-service (Ramaseshan, Kingshott, & Stein, 2015). It is a segment in which traditional banks are facing increasing competition from Fintech, financial technologies, whose business model is anchored in digital technologies, allowing them greater market capillarity (Anand & Mantrala, 2019; Stoeckli, Dremel, & Uebernickel, 2018; Puschmann, 2017).

In this context, there is an incentive to use self-service systems, with access by remote means such as internet banking, cell phone applications, and automated terminals (Pires & Costa Filho, 2008). Such experiences, considered strategic for the banking segment, have aroused interest by financial institutions about the perception of quality in their digital channels by their customers. Therefore, considering that the services provided by banking institutions differ little, the perception of quality by customers of self-service channels presents itself as a competitive differential (Choudhury, 2014; Malviya, 2015).

Given the above, the objective of this study is to identify the technological readiness factors associated with the quality perceived by customers who use digital services offered by banking institutions operating in Brazil. As a theoretical contribution, with studies presented on the propensity for users to technologies in the national literature (Souza & Luce, 2003; Pires & Costa Filho, 2008; Grohmann et al., 2014) and international (Vize, Coughlan, Kennedy, & Ellis-Chadwick, 2013; Ramaseshan, Kingshott, & Stein, 2015), as well as findings on perceived quality in consumer services (Amin, 2016; Al-Hawari, 2015; Malviya, 2015; Choudhury, 2014; Paul, Mittal, & Srivastav, 2016), this work relates technological propensity to perceived quality in digital banking services from Brazilian banks. That is the perception of the quality of bank customers optimistic, innovative, insecure, and constrained by the use of new technologies. Thus, as a gap to be filled, we seek a better understanding of the quality of services offered through the digital channels of financial institutions operating in Brazil, considering the growth, year after year, of consumer relations with their clients.

This study contributes to show the technological readiness of customers. However, it is a contributory factor for the perceived quality; the explanatory power of the model indicates that other factors also impact this relationship. In other words, although Fintech is growing at an accelerated pace, traditional bank customers seek other factors that impact perceived quality. In this way, it shows that traditional banks can consider other organisational actions to retain customers in addition to disruptive technologies.

Theoretical discussion
Technology readiness
With the technological evolution and the consequent revolution in technology-related services (Parasuraman & Colby, 2015), there has been a change in consumer behaviour, with the use of technological means to carry out transactions (Vize et al., 2013). Brahima (2013) also points out that, in the last decades, there has been considerable growth in the use of internet services, mobile technologies, and others related to connectivity.

Considering such a scenario of social connectivity, studies present a positive relationship between these new experiences and individuals, given the speed, convenience, security, and widening of physical boundaries (Brahima, 2013). However, other findings point to resistance, difficulties in understanding (Ferreira Rocha & Silva, 2014), challenges in handling, frustrations, or failures in services involving technologies (Parasuraman & Colby, 2015). Amin (2016) also argues that technological insecurity, habits, and interpersonal relationships are factors that contribute to obstacles in the use of new technologies. For Parasuraman (2000) and Parasuraman and Colby (2001), the use of technology in professional and personal life is based on a mental state resulting in inhibitors that determine its use. He lists the existence of positive aspects, such as the search for technologies, and negative ones, related to resistance to acceptance, such as insecurity and fears in this use.

Parasuramam (2000) researched the propensity of people to use new technologies, presenting a model called Technology Readiness Index (TRI). This model was divided into four categories that listed positive and negative aspects related to the individual's acceptance of the technologies (Parasuraman & Colby, 2001). Optimism, related to the affirmative acceptance for handling the technology; innovation related to leadership, getting ahead or anticipating the use of new technologies; discomfort, a feeling embarrassed by the use of new technologies; and insecurity doubt, distrust, failure, or belief about the risk in technological transactions.

In the international context, an initial study of the TRI model had its applicability verified in North American consumers (Parasuraman & Colby, 2001). However, considering the emergence of new products and services related to connectivity, this model was updated, producing a scale of 16 items, with the presentation of the Technology Readiness Index 2.0 (Parasuraman & Colby, 2015). The model was also adapted to the Brazilian context by Souza and Luce (2003), but with the consequences of two proposed variables: discomfort with embarrassment, discomfort with functional and physical risk, and insecurity with information and insecurity due to lack of personal contact. Pires and Costa Filho (2008) showed that optimism, insecurity, and discomfort influence the propensity to use online banking services in Brazil.

The literature also presents other research relating propensity to new technologies, arising from the Technology Readiness Index (Tri) model, to cognitive and affective aspects, with a demonstration of significance in this relationship (Ferreira, Rocha, & Silva, 2014). In the business-to-business (B2B) context, technological readiness is an important factor for satisfaction and quality of service in the retail sector (Vize et al., 2013). Moreover, therefore, Son and Han (2011) argue that the dimensions linked to technological propensity have different influences on post-consumer perception, portraying that the innovative dimension shows a positive relationship with the intention of repurchase and consumer satisfaction.

Perceived quality in self-service banking services
With the advent of connectivity, the emergence of mobile online technologies, speed, and dynamics in business relationships, the provision of self-service channels for use by customers are essential and strategic for the continuity of organisations (Kingshott, Sharma, & Chung, 2018). In this context, banking institutions have invested in means that facilitate and encourage the use of self-service technologies (self-service) by their customers. Such as the provision of relationship pages, applications on mobile devices (mobile banking), internet banking, and digital channels (Alalwan, Dwivedi, Rana, & Williams, 2016; Shaikh & Karjaluoto, 2015). As

favourable points for users in the sector, this form of self-service provides agility in accessing the deposit account, conducting business, investments, transactions, transferring funds, among others, bringing independence in the banking self-service process (Kaushik & Rahman, 2015; Paul, Mittal, & Srivastav, 2016). On the other hand, the availability of these means favours the reduction of operating and fixed costs for banks, control, agility, as well as providing new forms of relationship with their clients (Amin, 2016).

In this scenario, the quality of bank self-service terminals is relevant, since, considering that the services between these institutions are not very different (Malviya, 2015), it presents itself as a factor of organisational differentiation (Choudhury, 2014). Amin (2016) argues that the perception of quality in performing services is associated with customer satisfaction and loyalty. Zeithaml (1988) also shows that the perception of quality is related to excellence or superiority when comparing products. Paul, Mittal and Srivastav (2016) defend that the perceived quality is related to the client's expectations regarding the past performance of the service and its perception after its conclusion.

Considering the relevance of the perception of quality in self-service services, research on the topic has presented an extensive discussion in the literature (Amin, 2016; Al-Hawari, 2015; Malviya, 2015; Choudhury, 2014; Yoo & Donthu, 2001). In this context, a study that relates perceived quality to interaction through social networks suggests a positive relationship when applied through social media (Schivinski & Dabrowski, 2015). However, the literature on the quality perceived in services is still more concentrated in developed countries, being incipient in developing countries (Paul, Mittal, & Srivastav, 2016).

Methodology

The study population consisted of bank customers operating in Brazil, users of digital self-service channels (internet banking, mobile banking, Automated Teller Machine (ATM), and virtual service). The sample had 957 respondents whose profile (Table 1).

The instrument for data collection used the scales of the Technology Readiness Index (Tri) model, developed by Parasuraman (2000) and Parasuraman and Colby (2001), adapted to the Brazilian model by Souza and Luce (2003) for six constructs: optimism (10 items), innovativeness (seven items), discomfort with embarrassment (six items), discomfort with functional and physical risk (two items), insecurity with information (four items) and insecurity due to lack of contact (five items). For the construct of perceived quality, the construct developed in the study by Yoo and Donthu (2001) with six items was chosen. For all 40 statements, the five-point Likert scale was used to assess the degree of agreement: 1 [strongly disagree] to 5 [strongly agree].

The questionnaire was made available on the Google Forms application with two population control questions, to check whether the respondent was part of the target population: 'Are you a bank customer'? and 'Do you use the digital channels of your preferred bank (the most used)'? The questionnaire was complemented with questions related to the respondents' profile, such as account type (individual, legal, both), type of bank (public, private, cooperative, others), age, sex, education level, and average monthly income. As a first step in launching the questionnaire, a pre-test was applied to 21 users of digital banking channels, either electronically or in person. After listening to the respondents' suggestions, adjustments were made to five statements in order to clarify the terms better and facilitate the understanding of the questionnaire without impacting the integrity of the scales of the original authors.

Table 1. Sample profile

				%
Gender		Male	526	45
		Female	431	55
Age		Between 18 and 29	349	37
		Between30 and 39	373	39
		Between40 and49	147	15
		Between50 and 59	69	7
		More than 60	19	2
Education		High school	73	8
		Undergraduate	256	27
		Postgraduate	628	65
Income (in the minimum wage – R$)	More than 20	More than 20.900,00	65	7
	Between 15 to 20	Between 15.675,00 to 20.900,00	46	5
	Between10 to 15	Between 10.045,00 to 15.675,00	113	12
	Between05 to 10	Between 5.225,00 to 10.045,00	260	27
	Between01 to 05	Between 1.045,00 to 5.225,00	375	39
	Up to 01	Up to 1.045,00	98	10
Bank type		Public	684	71
		Private	273	29

n= 957. R$: Brazilian Reais. Dollar rate in February 2020: R$ 4.31.

For data analysis, Structural Equation Modelling (SEM) was used, using SMART-PLS 3 (Ringle, Wende, & Becker (2015) and also multigroup analysis to compare three groups - sex, income and type of bank The PLS algorithm with a maximum of 300 iterations and bootstrapping with 5000 subsamples was used.

Data Analysis
The validity of the measurement model
The convergent validity of the proposed model was supported by the criteria of the composite reliability coefficient, and rho_A (for most constructs), which are above 0.70 and the average extracted variance, which is at least 0.50, shown in Table 2.

Table 2. Convergent and discriminant validation using FornellandLarcker (1981) criteria

	α	Rho_A	CR	AVE	DE	DR	IC	II	IN	OT	PQ
Discomfort with embarrassment (DE)	0,719	0,760	0,816	0,532	**0,729**						
Discomfort with physical risk (DR)	0,623	0,728	0,834	0,716	-0,300	**0,846**					
Insecurity due to lack of contact (IC)	0,647	0,706	0,794	0,566	0,403	-0,363	**0,753**				
Insecurity with information (II)	0,810	0,827	0,874	0,635	0,371	-0,397	0,588	**0,797**			
Innovativeness (IN)	0,858	0,862	0,894	0,585	-0,049	0,091	-0,188	-0,225	**0,765**		
Optimism (OT)	0,833	0,836	0,875	0,500	-0,057	0,167	-0,182	-0,255	0,479	**0,707**	
Perceived quality (PQ)	0,773	0,801	0,845	0,525	-0,130	0,073	-0,175	-0,245	0,305	0,400	**0,725**

In bold, the square root of the extracted average variance (AVE); CR: Coefficient of composite reliability; α: Cronbach's alpha, from SmartPLS.

Three criteria supported the discriminant validity. First, that of Fornell and Larcker (1981) (Table 1). Second, the RacioHeterotrait-Monotrait (HTMT) by Henseler, Ringle&Sarstedt (2015), as shown in Table 3. And third, the cross-loading criterion by Chin (1998) (Table 4).

Table 3. Discriminant validity using Heterotrait-Monotrait Ratio (HTMT) criteria (Henseler, Ringle & Sarstedt, 2015)

	DE	DR	IC	II	IN	OT	PQ
Discomfort with embarrassment (DE)							
Discomfort with physical risk (DR)	0,435						
Insecurity due to lack of contact (IC)	0,531	0,603					
Insecurity with information (II)	0,468	0,568	0,813				
Innovativeness (IN)	0,094	0,127	0,262	0,272			
Optimism (OT)	0,099	0,238	0,245	0,300	0,571		
Perceived quality (PQ)	0,161	0,106	0,209	0,283	0,365	0,488	

Table4. Discriminant validity using the cross-loadings criteria (Chin, 1998)

		DE	DR	IC	II	IN	OT	PQ
Discomfort with embarrassment (DE)	DC1	0,538	-0,114	0,182	0,194	0,039	0,063	-0,037
	DC2	0,756	-0,227	0,231	0,274	-0,003	-0,029	-0,082
	DC3	0,818	-0,201	0,336	0,277	-0,058	-0,067	-0,108
	DC4	0,772	-0,285	0,367	0,316	-0,065	-0,064	-0,120
Discomfort with physical risk (DR)	DR1	-0,239	0,921	-0,296	-0,349	0,074	0,148	0,074
	DR2	-0,289	0,765	-0,341	-0,330	0,086	0,137	0,045
Insecurity due to lack of contact (IC	IC1	0,279	-0,235	0,763	0,447	-0,141	-0,139	-0,130
	IC3	0,240	-0,300	0,623	0,424	-0,176	-0,147	-0,058
	IC5	0,370	-0,317	0,854	0,483	-0,143	-0,143	-0,170
Insecurity with information (II)	II1	0,285	-0,305	0,540	0,764	-0,206	-0,230	-0,191
	II2	0,239	-0,341	0,415	0,759	-0,207	-0,159	-0,151
	II3	0,319	-0,302	0,465	0,844	-0,164	-0,221	-0,235
	II4	0,327	-0,332	0,452	0,818	-0,151	-0,192	-0,189
Innovativeness (IN)	IN1	0,015	0,022	-0,125	-0,148	0,720	0,371	0,231
	IN3	0,029	0,068	-0,108	-0,144	0,738	0,370	0,222
	IN4	-0,096	0,082	-0,200	-0,204	0,763	0,310	0,222
	IN5	-0,058	0,107	-0,141	-0,177	0,773	0,375	0,243
	IN6	-0,042	0,050	-0,079	-0,148	0,785	0,391	0,194
	IN7	-0,068	0,080	-0,193	-0,201	0,804	0,379	0,274
Optimism (OT)	OT2	-0,058	0,117	-0,161	-0,169	0,336	0,682	0,304
	OT3	-0,069	0,111	-0,193	-0,243	0,302	0,703	0,309
	OT4	-0,015	0,129	-0,082	-0,169	0,367	0,727	0,261
	OT5	-0,078	0,053	-0,167	-0,224	0,309	0,754	0,327
	OT6	-0,005	0,122	-0,077	-0,133	0,332	0,661	0,252
	OT7	-0,022	0,165	-0,064	-0,130	0,383	0,698	0,246
	OT8	-0,018	0,151	-0,124	-0,168	0,359	0,718	0,261
Perceived quality (PQ)	QP1	-0,089	0,057	-0,077	-0,099	0,220	0,258	0,702
	QP2	-0,025	-0,015	-0,053	-0,091	0,172	0,268	0,621
	QP3	-0,089	0,017	-0,098	-0,114	0,194	0,243	0,666
	QP5	-0,120	0,061	-0,168	-0,202	0,208	0,318	0,784
	QP6	-0,127	0,112	-0,198	-0,314	0,292	0,346	0,830

The validity of the structural model

Table 5 shows the relationships proposed in this research. As for the negative dimensions, the inhibitors of the propensity to use digital channels, the evidence shows that discomfort with embarrassment (β = -0.073 and p-value = 0.016) and discomfort with functional and physical risk (β = -0.069 and p-value = 0.036) negatively influence the perceived quality of customers. In

other words, the higher the discomfort with new technologies, the lower the perception of the quality of digital banking services. This evidence contradicts the findings of Son and Han (2011), who did not find a significant relationship between the discomfort construct and the use of innovative functions in technological processes.

Table 5. Structural model coefficients - direct effects

	Structural coefficient	Standard deviation	t-value	p-value
Discomfort with embarrassment →Perceived quality	-0,073	0,030	2,404	0,016
Discomfort with physical risk →Perceived quality	-0,069	0,033	2,101	0,036
Insecurity due to lack of contact →Perceived quality	-0,015	0,036	0,406	0,685
Insecurity with information→Perceived quality	-0,129	0,039	3,303	0,001
Innovativeness→Perceived quality	0,127	0,033	3,894	0,000
Optimism→Perceived quality	0,311	0,035	8,842	0,000

Note: adjusted R^2 = Pearson's Coefficient of Determination = 0.197. Source: Research data.

Insecurity due to lack of contact negatively influences perceived quality (β = -0.129 and p-value= 0.001). In other words, the greater the absence of human contact, the lower the perception of the quality of digital banking services. Unlike insecurity with information (β = -0.015 and p-value = 0.685), which did not show a statistically significant relationship with the perceived quality of digital banking services. In this sense, a study by Hanafizadeh et al. (2014) shows that the cultural context with a high degree of uncertainty can contribute to increased risk perception. This factor is related to the insecurity in the use of digital media, in which mobile banking, for example, may represent a threat to the security or privacy of users.

As for the positive dimensions, inducing the propensity to use new technologies, innovativeness (β = 0.127 and p-value = 0.000) and optimism (β = 0.311 and p-value = 0.000), both positively impact the perceived quality of bank customers. In other words, the more the customer assimilates accepts and appropriates new technologies, the greater the perceived quality of digital banking channels. Grohmann et al. (2014) presented results that show a significant positive relationship between individuals considered to be optimistic regarding the continued use of new technologies and the perceived quality of such technologies, and their use favours efficiency, productivity, and increased customer satisfaction. (Liljander et al., 2006).

Concerning users oriented to innovativeness, the results also showed significance in the perception of quality in the banking self-service means, portraying the positive relationship for the use of digital channels by such individuals. This evidence means that users who are pioneers in the use of new technologies perceive quality in the digital channels offered by banks to their customers. In this sense, Grohmann et al. (2014) argue that people more adept at innovativeness exhibit a search for new technologies, and when they face difficulties, they tend to discontinue digital services. In France, Leicht, Chtourou, and Youssef (2018), on the adoption of autonomous cars and Kaabachi, Mrad, & Petrescu (2017) on the adoption of internet banking services showed that people more focused on innovativeness are more confident, that is, they perceive a lower risk. Therefore, they are more likely to use new technologies.

The analysis between the groups of sex, income, and the type of bank of the respondents indicated that only the relationship between innovativeness and the perceived quality in the group of public and private banks (β = -0.157 and p-value = 0.029) is significant (Table 6). That

is, customers of private banks agree that they are more likely to accept and use new technologies from digital channels than customers of public banks.

*Table 6.*Multigroup analysis (MGA)

Structural coefficients - the difference between groups

	Gender			Income			Bank type		
	β	Original p-value	New p-value	β	Original p-value	New p-value	β	Original p-value	New p-value
DC → QP	0,120	0,051	0,103	0,029	0,308	0,617	-0,024	0,637	0,727
DR → QP	0,104	0,118	0,236	-0,038	0,710	0,580	-0,007	0,533	0,934
IC → QP	-0,025	0,641	0,719	-0,049	0,719	0,561	-0,022	0,580	0,840
II → QP	0,034	0,324	0,648	-0,039	0,687	0,627	0,031	0,364	0,728
IN → QP	0,041	0,265	0,531	-0,035	0,696	0,608	-0,157	0,986	0,029*
OT → QP	-0,059	0,798	0,403	-0,042	0,722	0,556	0,090	0,135	0,270

* p-value <0.05.
Note: Discomfort with embarrassment (DE); Discomfort with physical risk (DR); Insecurity due to lack of contact (IC); Insecurity with information (II); Innovativeness (IN); Optimism (OT); Perceived quality (PQ).
Gender: male = 536; female = 431; Income: up to five minimum wages (R$ 5,225.00 - classes C, D, E) = 473; above this value - classes A and B) = 484; R$: Brazilian Reais. Dollar rate in February 2020: R$ 4.31; Bank Type: public = 684; private = 273.

Conclusion

The results of this study show that optimism, innovativeness, insecurity with information, and embarrassment contribute to explain the quality perceived by customers in the services offered by financial institutions through their digital channels. Regarding the factors that induce the propensity to use new technologies - optimism and innovativeness - that impact the quality of digital channels, this is good news for the banking sector, as technologies are changing the modus operandi of relating to customers (Bolton et al., 2018). The trend is to close physical branches and maintain the banking relationship through technology. In Brazil, according to the Association of Managers of Banco do Brasil, the big banks – Bradesco, Itaú and Banco do Brasil– intend to close about 1,200 branches by the end of 2020. This situation is a response to competition from Fintech and pressures from regulatory (e.g., change in the interest rate on overdraft) through an adjustment in their cost structures and investments in technology, mainly in digital channels (AGEBB, 2010).

In this way, banking institutions can adopt strategies in order to minimise the perception of insecurity in the use of digital channels by customers, considering that this factor tends to be an inhibitor of the perception of quality, which may impact in reducing the use of new technologies (Hahn & Scherer, 2014). Khedmatgozar and Shahnazi (2018) showed that Iranian customers are afraid to use the digital channel, internet banking, due to the perceived risk.

Thus, this study contributes to show the technological readiness of customers. However, it is a contributory factor for perceived quality; the explanatory power of the model indicates that other factors also impact this relationship. In other words, although traditional banks are facing increasing competition from Fintech, they apparently should look for other factors that impact perceived quality. Therefore, consider other organisational actions to retain customers in addition to disruptive technologies. That is, it contributes to research that relates the propensity of new technologies to the perception of quality by users of digital self-service services provided by Brazilian banks. Another significant contribution concerns the understanding of the quality of services in the digital self-service channels offered by financial institutions to their clientele from the perspective of the acceptance of technology by people.

As practical implications, financial institutions can invest in security technologies in their self-service digital channels in order to minimise the perception of technological insecurity by

their customers, as this is a relevant element in the perception of the quality of digital channels. Another implication is the investment in awareness campaigns for users of these services, aiming at the migration to the digital self-service available. In addition, we highlight the convenience of investing in innovative digital technologies for self-service as a way of retaining customers who have an affinity and predisposition to use new technologies. The research suggests an empirical basis for promoting incentive campaigns for bank customers with a view to the use of digital channels, encouraging the use of self-service services available and investments in innovative self-service technologies, with recognised technological security by users of digital channels. These measures allow greater control of transactions, optimisation of costs with personalised services, the realisation of strategies for organisational differentiation, and assistance in decision making by the management of financial institutions.

As limitations of this research, the sample used was restricted only to capable customers of financial institutions that use digital self-service channels. As a recommendation, a broader field of study is suggested, involving users who say they are not users of the digital channels of financial institutions, aiming at obtaining more comprehensive results concerning the perception of quality in digital self-service channels, including the barriers to customer adherence. Future studies could explore the relationship with other variables of technological services that are associated with the perception of quality in digital self-service means. It is also suggested research relating the variables studied among them, seeking to identify moderating or mediating dimensions with the quality perceived in digital self-service channels. Other studies can investigate how digital self-service services in financial institutions have their quality perceived in certain groups such as gender, age, education, marital status, and others.

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Conflict of Interests
No, there are no conflicting interests.

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