Pregledni naučni rad

Datum prijema: 26.03.2022. god.
Datum prihvatanja: 31.05.2022. god.

DOI: 10.5937/bankarstvo2202147H

KAKO BIG DATA ANALITIKA TRANSFORMIŠE FINANSIJSKU INDUSTRIJU

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Rezime

Revolucija podataka koja se dešava širom sveta donela je transformaciju u sektoru finansijskih usluga. Ove ogromne količine informacija otvorile su vrata razumevanju potreba kupaca, pronalaženju uvida i smanjenju rizika. Pored toga, pomažu industriji finansijskih usluga da preduzme mere za poboljšanje zadovoljstva klijenata brže nego što je to ranije bilo moguće. Finansijske firme mogu da razviju nove uvide koristeći BD jer sada mogu da prikupe veliku količinu podataka o svojim klijentima i njihovom obrascu potrošnje, a mogu da pružaju usluge koje su korisne, pogodne i brze za klijente. Oni mogu proširiti upotrebu tih uvida ne samo za svoje potrošače, već i za njihovu internu optimizaciju procesa, što je od koristi svima u procesu. Iako je uticaj BDA na kompanije za finansijske usluge sveprisutan, nije objavljeno toliko studija da bi se razumelo koji aspekti industrije finansijskih usluga mogu imati velike koristi od uspona tehnologije i BDA. Nekoliko objavljenih studija bavi se izazovima sa kojima se banke suočavaju u ovoj tehnološkoj eri ako nemaju implementirane BD alate. Ovo istraživanje obuhvata podatke iz banaka od januara 2019. do januara 2022. god. kako bi se rešio taj jaz od nekoliko banaka iz Amerike i Evrope koje su se suočile sa opadanjem zadovoljstva klijenata. Ovo istraživanje otkriva i najbolje metode koje finansijske kompanije širom sveta koriste za implementaciju BDA radi poboljšanja usluga. Ovaj rad će takođe razmotriti kako je BDA uspešno korišćen u bankarskoj industriji, a u vezi sa sledećim elementima: ponašanje potrošača, korišćenje kanala, obrazac potrošačke potrošnje i kreiranje profila, unakrsna prodaja proizvoda zasnovana na profilisanju korisnika, analiza povratnih informacija i raspoloženja, upravljanje sigurnim transakcijama i prevarama itd. Ova studija pomaže da se otkrije i da doprinos o tome kako industrija finansijskih usluga, kao što su banke, može da iskoristi BDA i pruži superiorne usluge. Dalja istraživanja bi se mogla sprovesti među drugim igračima u finansijskoj industriji kako bi se saznalo kako na njih utiče BDA.

Ključne reči: Analitika velikih podataka, finansije, aplikacije, banke, mašinsko učenje

Skraćenice: BDA (Big Data Analytics) – Analitika velikih podataka, BD (Big Data) - Veliki podaci, CS (Customer Satisfaction) - Zadovoljstvo kupaca

JEL klasifikacija: C55, G20, G21

Uvod

Revolucija podataka je zabeležila ogroman rast kod finansijskih kompanija. Iako je prikupljanje ovih informacija bilo improvizovano, s obzirom na to da finansijski sistem obično prikuplja mnogo podataka, mogućnosti koje otvara BDA prevazilaze sva očekivanja koja su prethodno bila predviđena u vezi sa ovim istorijskim rekordom. Ove informacije su takođe pomogle da se otkriju tajne tokova novca, izbegnu rizici i razume ponašanje potrošača. BD bankama pruža mogućnost da efikasnije i brže izvuku vredne informacije od svojih klijenata kao i iz sopstvenih podataka. Banke već osećaju prednosti korišćenja ovakve analitike.

Izveštaj Munara i dr. je otkrio da su kompanije u sektorima finansijskih usluga koje su implementirale BDA postigle više uspeha od drugih koje ga nisu koristile (Munar, Chiner, & Sales, 2014). Korist nije ograničena na industriju finansijskih usluga, već na sve industrije. BDA neće samo podržati finansijske institucije da imaju koristi od velikih količina podataka, već će im pomoći i da ostvare prednost nad konkurencijom, smanje troškove i transformišu izazove u prilike. Banke koriste BDA da razviju uvid i poboljšaju upravljanje kapitalom, alokaciju kapitala i kontrolu resursa. Jedno istraživanje (Munar, Chiner, & Sales, 2014) je otkrilo da 59,3% finansijskih i nefinansijskih firmi u Americi i Evropi koristi BDA i analitiku informacija, pokazujući veliku prednost u odnosu na konkurenciju, a 91,2% misli da će prosperitetna primena BDA dugoročno odrediti pobednike (Gupta, Gupta, Agraval i Kansal, 2019). Ali samo 32,3% finansijskih kompanija ima solidno razumevanje BDA, a ostatak se redovno fokusira na pilote i eksperimente na tu temu (Gupta, Gupta, Agraval, & Kansal, 2019).

Dok korišćenje BDA donosi značajnu korist svetu poslovanja u bilo kojoj industriji, mnoge banke i dalje zaostaju u pogledu implementacije najnovijih BD alata. Tako neki od njih ne ispunjavaju očekivanja svojih kupaca. Ova studija razmatra neke takve banke i procenjuje kako bi se one mogle poboljšati. Studija daje značajan doprinos razumevanju izazova nedostatka BD metode analize. Studija takođe pokazuje prednosti posedovanja BDA alata.

Pregled literature

Šta je BDA?

BD se definiše kao ogroman rast i dostupnost podataka, organizovanih i neorganizovanih (Gupta, Gupta, Agraval, & Kansal, 2019). Autor dodaje da je BD čista masa podataka koji se dnevno proizvode unutar globalnih mreža tempom koji prevazilazi kapacitet trenutnih baza podataka. Istraživanja (Bedelei & Iier, 2014) su definisala BD ne samo po količini informacija, već i po njihovoj raznovrsnosti, složenosti i brzini kojom se podaci moraju analizirati ili dostaviti; 3V je naime:

• Obim (Volume): Obim se odnosi na količinu podataka izvan mogućnosti analize putem konvencionalnih alata, kao što su statistički analitički alati ili standardni analitički alati. Hasani i dr. (Hassani, Huang, & Silva,, 2018) dodaju da obim uskladištenih podataka brzo raste, a Indriasari i dr. (Indriasari, Gaol, & Matsuo, 2019) predviđaju da će do 2022. godine biti uskladišteno 90 zetabajta podataka svake godine.

• Brzina (Velocity): Odnosi se na brzinu prikupljanja podataka. Konvencionalne obaveštajne aplikacije koriste prethodne podatke iz dana, meseci ili kvartala unazad, dok se BD oslanja na podatke u realnom vremenu kako bi brzo pružio uvid. Sproviero (Sproviero, 2020) navodi da brzina BD zavisi ne samo od brzine protoka podataka, već i od tempa kojim se oni prikupljaju, analiziraju i preuzimaju.

• Raznolikost (Variety): BD pristupa svim vrstama informacija izvan tradicionalnih strukturiranih i nestrukturiranih podataka i onih uskladištenih u skladištu podataka. Takođe može da asimiluje uskladištene i strukturirane i nestrukturirane podatke dobijene od eksternih izvora (Amakobe, 2015).

Radmer i dr. (Radmehr & Bazmara, 2017) pominju da mogućnost primene sofisticiranih algoritama i moćnih računara na velike skupove podataka, otkrivajući korelacije i uvide koji su ranije bili nedostupni kroz konvencionalno skladište podataka ili BI alate, čini BD drugačijim od samo „više podataka".

Prema novoj studiji (Delgosha, Hajiheidari, & Fahimi, 2020), različite industrije, uključujući bankarstvo i finansijske usluge, iskusile su ogroman potencijal koji nudi kombinacija uspona tehnologije i analitike. Izveštaj je otkrio da kompanije moraju da usvoje BDA da bi unapredile svoju ponudu. Istraživanje (Iu & Song, 2021) je pokazalo da je 37% organizacija prijavilo da koristi naprednu analitiku, dok je 85% reklo da će se time baviti u roku od tri godine. Istraživanje (Gupta, Gupta, Agraval, & Kansal, 2019) dodaje da je žurba ka implementaciji BDA posledica promena u poslovnom okruženju i potrebe da se iskoristi više poslovnih prilika. Napredna analitika je postala najbolji način za otkrivanje novih segmenata kupaca, identifikaciju dobavljača, povezivanje proizvoda i afiniteta i razumevanje prodaje. San i dr. (Sun, Morris, Ksu, Zhu, & Ksie, 2014) citirali su istraživanje 550 donosilaca odluka u preduzećima, koji su izjavili da su usvojili BD i analitiku kako bi poboljšali privlačenje kupaca, pomogli u razvoju novih proizvoda i upravljali i stekli konkurentsku prednost.

Firme kao što je Fejsbuk su uspešno stekle konkurentsku prednost, posebno zato što je analitika osnova poslovnog okruženja u kojem posluju. Prema istraživanju (Srivastava, Singh, Tanvar, & Tiagi, 2017), Fejsbuk je razvio sofisticirane profile potrošača koji pomažu organizaciji da cilja oglašavanje sa takvom preciznošću da se novi rivali ne mogu ni nadati da će ih sustići.

Majkrosoft je takođe, prema istraživanju (Sproviero, 2020), redefinisao upravljanje ljudskim resursima koristeći socijalnu analitiku, primoravajući mnoge organizacije da shvate da postoji novi put ka uspehu.

BD omogućava finansijskim firmama da usvoje inovacije na više frontova, donoseći nove proizvode i usluge na tržište (Boumlik & Bahaj, 2017). Većina proizvoda koje finansijske kompanije nude omogućavaju im da prikupljaju detaljne podatke o svojim klijentima, što zauzvrat hrani BDA alate koje koriste za dalje poboljšanje proizvoda. Stručnjaci za finansije definišu BD kao alat koji omogućava organizaciji da proizvodi, manipuliše i upravlja velikim skupovima informacija u određenom vremenskom okviru, kao i skladišnim prostorom potrebnim da podrži količinu informacija koju karakterišu raznovrsnost, brzina i obim (Munar, Chiner, i prodaja, 2014). Naš fokus u ovom izveštaju je da ispitamo oblasti u kojima finansijske institucije koriste BD da poboljšaju svoje okvire za upravljanje poslovnim rizicima kako bi poboljšali izvršni, revizijski i transparentni nadzor rizika (Mungai & & Baiat, 2018). Jedan od najvažnijih aspekata korišćenja BDA u finansijskim firmama je smanjenje rizika (Hassani, Huang, & Silva, 2018). Ovde će studija istražiti metode u kojima se koristi analiza podataka da bi se otkrio obrazac ponašanja potrošača korišćenjem BDA i otkrivanje korelacije između krađe novca i karakteristika transakcije i različitih tipova transakcija (Wong & Wong, 2020).

Prikaz problema i upotreba BD-a

Studija uzima u obzir podatke iz više banaka širom SAD i Evrope.

Odabrani su na osnovu opadanja zadovoljstva njihovih klijenata tokom određenog vremenskog perioda. Većina ovih banaka radi više od dvadeset godina i imale su poteškoća da ožive profitne marže nakon ekonomske krize nakon 2008. godine. Od 2012. godine pa nadalje, mnoge od njih su počele da prikupljaju što više podataka od potrošača do različitih aspekata potrošačke potrošnje.

Takođe su prikupile povratne informacije od potrošača kako bi prepoznale i rešile probleme sa svim problemima vlasnika bankovnih računa. Neke od njih su doživele pad u merenju zadovoljstva kupaca, zajedno sa smanjenjem zadržavanja klijenata. Prikupili smo podatke od banaka da bismo razumeli sledeće:

- Utvrđivanje pravog uzroka smanjenja zadovoljstva klijenata u više banaka
- Analiziranje obrasce potrošnje korisnika kartica
- Procena korišćenja kanala – zaduživanje i kredit itd.
- Razumevanje ponašanja potrošača

U našem slučaju, razmatraju se sledeće tačke:

- Detalji transakcije za vlasnike kartica (skup od oko 25.000 zapisa), za vremenski period januar 2019. - januar 2022.
- Lako dostupan pristup za 25.000 fajlova koji se čuvaju kod treće strane, a koje banke koriste za prikupljanje povratnih informacija.

Metodologija

Studija počinje analizom merenja zadovoljstva klijenata. Podaci su prikupljeni od više banaka širom sveta, od SAD do Evrope.

Podaci se koriste za razumevanje ponašanja potrošača, obrazaca potrošnje i korišćenja bankarskih usluga. Studija takođe analizira kako su banke koristile BDA za rešavanje zabrinutosti bankarskih klijenata. Pošto veliki deo uloge potrošača zavisi od usluga, studija će koristiti skup metrika da bi se razumeo kvalitet usluga koje banke pružaju i brzina kojom su problemi rešeni. Ovo će nam pomoći da shvatimo da li su problemi sa kojima su se banke suočile nastali zbog loših usluga ili možda drugih problema. Odmah nakon segmentiranja problema analizom povratnih informacija, studija će pokušati da pronađe objašnjenje zašto je do toga došlo, kao i da predloži poboljšanja.

Nalazi i analiza

Analiza odgovora

Postupci za dobijanje povratnih informacija su od suštinskog značaja za svaku grupu kako bi vam pomogli da razumete pogodne oblasti za razvoj. Naravno, ako se obavljaju redovno, pomažu u identifikaciji nedostataka u pruženim uslugama. Banke su dodatno počele da prikupljaju odgovore od svojih klijenata; od ljudi koji su posetili banke i od ljudi koji su koristili internet usluge.

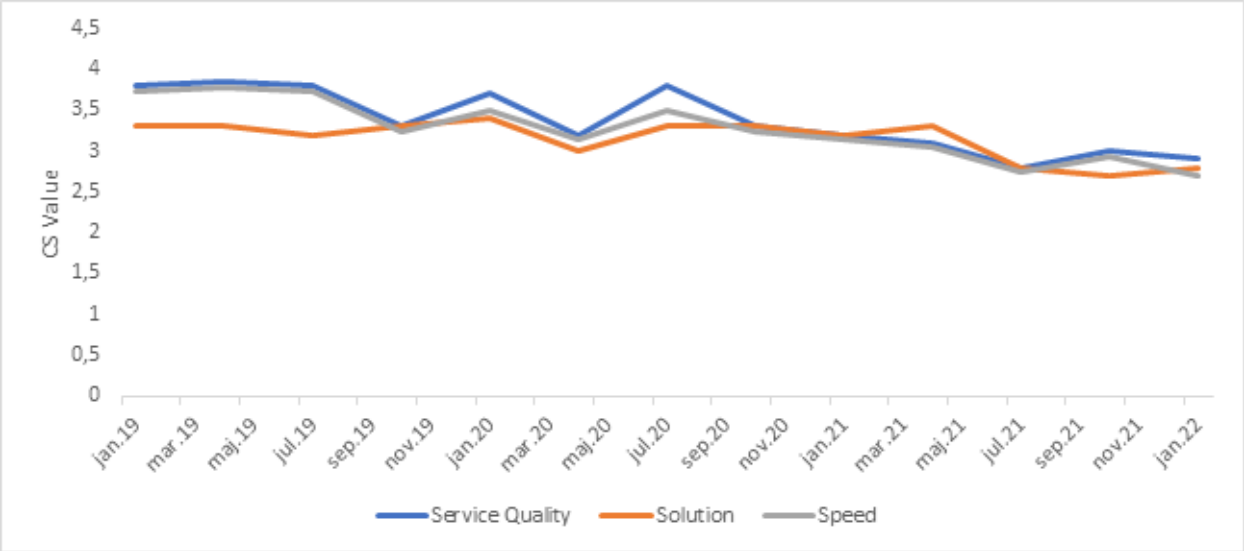
Prikupljanje podataka i veličina uzorka

Procena u nastavku je sprovedena korišćenjem celokupnih prikupljenih podataka, koji sadrže povratne informacije od približno 25.000 kupaca. Sledeći podaci su prikupljeni i objedinjeni tokom dve godine. Od klijenata koji pristupaju nekim bankama zatraženo je da anonimno ocene banku na skali od jedan do pet prema sledećim parametrima:

- Da li je kupac zadovoljan kvalitetom usluge?
- Da li je kupac zadovoljan brzinom usluge?
- Da li se upiti potrošača efikasno rešavaju?

Analiza odgovora i zaključivanje

Rezultati neposredno pre februara 2019. su stabilni i spori. Zadovoljstvo programom, kvalitet usluge i brzina obrade upita su skoro svi uračunati sa istom težinom. Klijenti su rangirali proizvode finansijskih firmi kao normalne, a takođe finansijske firme nisu učinile korektivne korake za poboljšanje rejtinga klijenata.



Grafikon 1: Povratne informacije prema različitim parametrima

Ipak, između januara 2018. i marta 2019, „kvalitet usluge" zajedno sa „efikasnim rešavanjem upita" imaju nisku korelaciju = 0,401. To znači da kvalitet usluge nije bio u korelaciji sa rešavanjem upita. U istom periodu, „kvalitet pružene usluge" i „brzina pružanja usluge" imaju veliku korelaciju = 0,692, što pokazuje da su kvalitet i brzina usluge bili u korelaciji, dok je opšti rezultat ostao tipičan. To implicira da je kvalitet postao neposredna manifestacija brzine kvalitetne usluge. Ukoliko je tempo usluge poboljšan, klijenti su uočili odgovarajući razvoj u okviru kvaliteta usluge. To znači da ljudi vide tempo kao sve važniji parametar. Brzina i rešenje imaju nisku korelaciju od 0,365.

Korelacija	Kvalitet	Rešenje	Brzina
Kvalitet	1,000	0,401	0,692
Rešenje	0,401	1,000	0,365
Brzina	0,692	0,365	1,000

Tabela 1: Korelacija

Postoje određena poboljšanja u okviru metode od januara 2019. do aprila 2019. Retki skokovi čine da finansijska firma zahteva različite korake kako bi povećala zadovoljstvo klijenata.
Ako iz studije izvučemo znatno jednostavniji pogled na tri nedelje od aprila 2019. do juna 2019. godine, može se utvrditi da redovni kupac obavi najmanje tri transakcije u nekom periodu dana. Drugi deo studije će pokušati da izoluje pravi uzrok pada ocena zadovoljstva klijenata banaka i proceniće i razmotriti različite strategije koje se koriste u analitici. Kao što je ranije rečeno, sledeće će biti osnova dela studije: skup podataka o bankama uključuje istoriju transakcija korisnika kartica od januara 2019. do januara 2022. godine i takođe će biti ispitani prema dole navedenim glavama.

Obrazac transakcije

Pogledajmo uobičajenu upotrebu kartica po mesecima svake sezone, u periodu od 2019. do 2022. Studija će analizirati veb transakcije preko kartica i ispitati modne trendove u obrascima kreditiranja i debitnih obrazaca vlasnika kartica.

Ukupno transakcija po mesecima

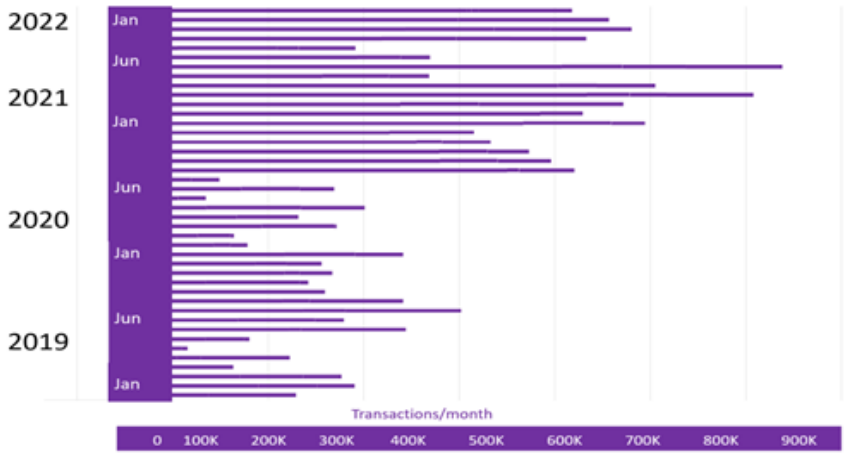


Tabela 2: Ukupno transakcija po mesecima u bankama

Zapažanja: Kako studija otkriva, i dalje postoji porast gotovine koja se distribuira u periodu od 2019. do 2022. Studija takođe primećuje da je za mnoge kartice, iako se obim gotovinskih transakcija poboljšao, isti ostao dosledan za druge ljude. Postoji nekoliko kartica koje su premašile ukupan iznos transakcija od ostalih metoda, tako da je njihova neto potrošnja bila mnogo veća od ukupne zarade za to vreme.

Ukupne debitne transakcije
Zapažanja: I dalje postoji postepeni porast ukupnog novca koji leže direktno na račune. Ovo je u skladu sa time kako se vrednost finansijske imovine povećava tokom vremena za skoro svaku finansijsku instituciju. Za račune vlasnika kartice, očigledno je povećanje gotovine koja se prima svakog meseca.

Zaključak: Ovaj vlasnik kartice može biti osoba koja ima normalnu platu, sa godišnjim porastom neto prihoda. Varijacije mogu biti posledica prilagodljive komponente prihoda, ali bi se osnovna plata u ovom slučaju poboljšala. Identifikacija „zdravih" vlasnika kartica sa normalnom plato mogla bi dodatno da ide na ruku bankama, jer se ovim vlasnicima kartica može pristupiti sa boljim uslovima štednje, robom i sistemima odgovornosti. Ostatak slotova za kartice može biti ugovorno osoblje ili možda imaju neujednačene izvore prihoda. Identifikacija vlasnika kartica bez plata može pomoći bankama da razviju i obezbede proizvode kao što su mali štedni programi, kao i programi fiksnih depozita sa atraktivnim prinosima.

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Ukupne kreditne transakcije

Zapažanja: Postoji slab porast ukupnog kreditiranja svakog računa svakog meseca svake godine.
Postoji verovatna sezonalnost u obrascima potrošnje. Mnogi faktori mogu uticati na to, kao što su makroekonomski uslovi, praznična sezona, prihodni izvori subjekata koji se posmatraju i prakse potrošnje subjekata koji se posmatraju.
Zaključak: Takvi potrošači bi mogli imati velike koristi od ponude kreditnih kartica, omogućavajući im da troše više da zadovolje svoje potrebe u različitim prilikama, a istovremeno omogućavajući više transakcija za banke. Klijent takođe ostaje lojalan banci ako su ispunjeni njegovi zahtevi.

Analiza ponašanja potrošača zasnovana na analizi korišćenja kanala

Dinamika transakcija se smatra važnim parametrom za poznavanje zahteva i navika klijenta. Sledeće vrste transakcija se posmatraju za slučaj kao što su kreditna transakcija i debitna transakcija.

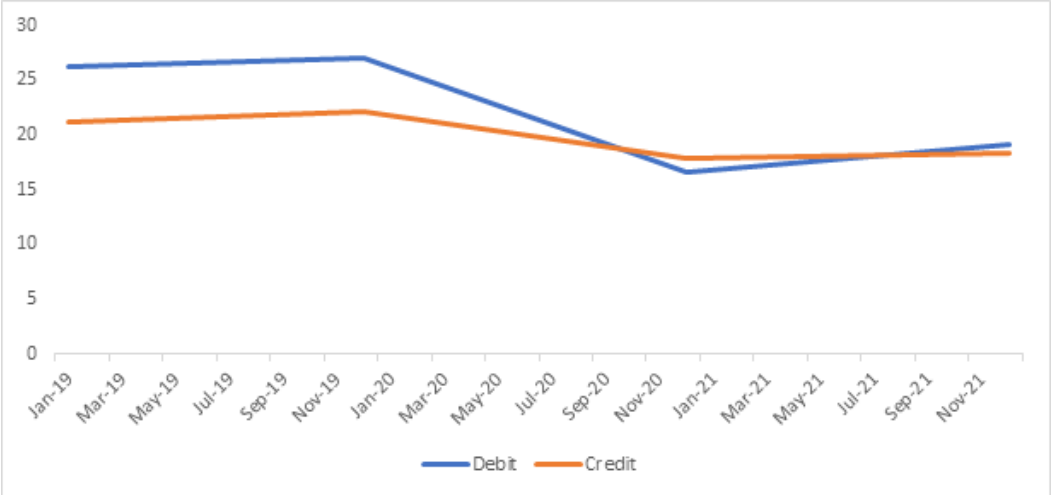

Tabela 3: Korišćenje kanala

Zapažanja: Na osnovu upotrebe debitnih i kreditnih kartica, primećeno je da su debitne transakcije obično veće od kreditnih transakcija po korisniku. Kao što se vidi na gornjem grafikonu, učestalost debitnih transakcija je obično oko 20% veća. Međutim, uočavamo i zanimljiv fenomen gde su transakcije kreditnom karticom gotovo postale jednake transakcijama debitnih kartica, uglavnom zbog smanjenja učestalosti transakcija debitnim karticama. Zbog vremena, procenjujemo da je to posledica uticaja Covid-19 na smanjene zarade ljudi, što je dovelo do toga da ljudi češće koriste kreditne kartice. Trend se nastavio do kraja 2021. kada se zatvaranje vezano za Covid završilo i kada su se preduzeća počela otvarati, što je rezultiralo time da ljudi zarađuju više i stoga češće koriste debitne kartice.

Analiza ponašanja potrošača zavisi od obrazaca potrošnje za unakrsnu prodaju

Studija takođe može da koristi informacije o transakcijama da proceni kojim potrošačima se mogu prodati koje vrste finansijskih proizvoda. Takođe ga koriste banke za segmentiranje i ciljanje potencijalnih klijenata. Ispod je kompilacija informacija iz našeg skupa podataka, za naš skup podataka, u cilju analize ponašanja kupaca za svrhu unakrsne prodaje i prodaje finansijskih proizvoda klijentima.

Zapažanja: Gornji grafikon prikazuje optimalne obrasce zaduženja i najviše trendove kreditiranja za vlasnike kartica. Kao što je primećeno, sa promenom vremenske linije, upotreba ovih kartica se povećava, a to povećava moć ulaganja; a kako se kapacitet potrošnje povećava, produžena potrošnja debitnih kartica se dodatno poboljšava. Ne samo da im se povećava iznos potrošnje, već se povećava i njihova učestalost potrošnje. Na osnovu analize ponašanja kupaca, studija može zaključiti sledeće - Ova osoba ima kapacitet da investira, i iako povremeno, ulaže mnogo više od onoga što se vidi posmatrajući njihovu potrošnju tokom određenog vremenskog perioda. I tako, ova osoba je savršen kandidat za potencijalni kredit. Ova osoba dodatno pokazuje da, kako se njihov kapacitet za investiranje povećava, internet zaduženje dodatno raste. Dakle, ovaj pojedinac je dodatno savršen izbor za korišćenje kreditne kartice. Može im se ponuditi platna kartica, ili u zavisnosti od toga da li je već koriste, njihov kreditni limit se može povećati. Mogućnosti vezane za kreditnu karticu mogu se proširiti na ovu osobu, jer je mnogo verovatnije da će svoju karticu koristiti.

Analiza bezbednosti i prevara

Na osnovu istorijskih transakcija i potrošačkih kapaciteta klijenata, analiza ponašanja može nam pomoći da otkrijemo moguću pretnju i prevare koje su se mogle desiti u prošlosti. Ako je zapaženo da je klijent učestvovao u prekomernim transakcijama sa sumnjivim računima, može se označiti, a mogu se izvršiti dodatna ispitivanja kako bi se osiguralo pravilno korišćenje finansijskih sredstava. Ako je klijent u prošlosti vršio lažne aktivnosti, njegovi transferi mogu biti označeni dok se ne preduzmu odgovarajuće mere za rešavanje bilo kakve zabrinutosti. Na taj način banke mogu osigurati da su subjekti sa kojima klijenti posluju zaštićeni, kao i da su klijenti zaštićeni od lažnih subjekata.

Broj neto debitnih transakcija mesečno, svake godine

Kada se u studiji pogledaju debitne transakcije koje su se desile tokom istog perioda, dobijamo nekoliko intrigantnih rezultata. Ispod će biti prikazan prikaz svih ukupnih debitnih transakcija za odgovarajuće vlasnike kartice. Zapažanja: Broj neto transakcija raste s vremenom i suptilno.

Banke mogu da koriste podatke da bi razumele probleme kao što su iznenadni skokovi, koji se mogu koristiti za nezakonite transakcije i takođe mogu predložiti moguće kompromitovanje proizvoda. To jasno ukazuje na neovlašćeni pristup i malverzacije sa novcem od strane nepoštenih agenata.

Analiza trenda vremena transakcije za celu 2021

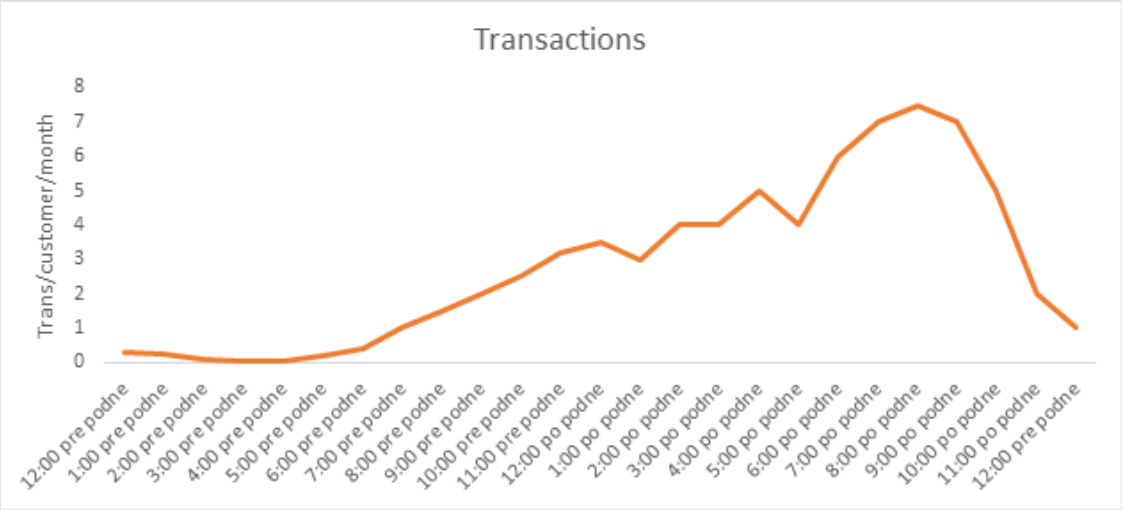

Tabela 4: Trend transakcija

Zapažanja: Uobičajeno se očekuje da se transakcije karticama odvijaju između 08:00 i 23:00 časova, pošto je to period u kome rade redovne kompanije.

Počevši od ponoći, pa do ranih jutarnjih sati, vidimo manje transakcija, što pokazuje da korisnici ne koriste toliko ovaj način plaćanja kasno u noć. Međutim, počevši od 06:00 ujutru, posmatramo rast transakcija prema očekivanjima, koji dostiže vrhunac oko 20:00, kada ljudi možda koriste svoje kartice u različite svrhe kao što su kupovina u prodavnicama ili restoranima.

Zapažanja: Uobičajeno se očekuje da se transakcije karticama odvijaju između 08:00 i 23:00 časova, pošto je to period u kome rade redovne kompanije. Počevši od ponoći, pa do ranih jutarnjih sati, vidimo manje transakcija, što pokazuje da korisnici ne koriste toliko ovaj način plaćanja kasno u noć. Međutim, počevši od 06:00 ujutru, posmatramo rast transakcija prema očekivanjima, koji dostiže vrhunac oko 20:00, kada ljudi možda koriste svoje kartice u različite svrhe kao što su kupovina u prodavnicama ili restoranima.

Korelacija između zapažanja
Jedna od banaka koju smo proučavali suočila se sa zastojem zbog tehničkih kvarova tokom perioda istraživanja i tog dana smo prikupili zadovoljstvo klijenata za tu konkretnu banku i uporedili ga sa normalnim danima.

Analiza zadovoljstva klijenata: U ranim jutarnjim satima banka je naišla na sajber napad, prilikom kojeg su za kupovinu korišćene kartice. Aktivnost hakovanja je pauzirana nakon 16. maja 2021, i samim tim prestala je da postoji oko 10. juna 2021. Skoro istog trenutka, lista za merenje zadovoljstva klijenata banke smanjila se za tri indeksna poena. To znači da se problem desio u širokom krugu delatnosti, a klijenti su bili pogođeni u velikom broju. Zaposleni u banci su poboljšali zaštitu svog internet sistema kako bi izbegli još više prevarnih transakcija. Ovo je očigledno, pošto nakon događaja nisu pronađene prevarne transakcije. Banka je takođe radila na smirivanju stresnih kupaca, a radila je i na kontroli oštećenja brenda. Ovo je dodatno vidljivo iz činjenice da lista za merenje zadovoljstva klijenata nastavlja da raste nakon incidenta i da je dostigla stepen pre maja 2021.

Budući obim istraživanja

Studija bi se mogla proširiti na testiranje i kvantifikaciju finansijskih i nefinansijskih prednosti koje su banke dobile nakon uvođenja BDA i predviđanja poboljšanja u finansijskim izveštajima banke. Rad se takođe može proširiti na različite metode prikupljanja podataka koje banke mogu koristiti za poboljšanje kvaliteta analize. Neki dodatni obim istraživanja mogao bi biti obrazac upotrebe specifičnog finansijskog instrumenta koji se uzima u obzir BDA, kao što su hartije od vrednosti obezbeđene hipotekom, stambeni krediti itd., koji imaju široke implikacije u finansijama i na koje korišćenje BDA u velikoj meri utiče.

Zaključak

Uspon tehnologije omogućio je finansijskim institucijama da prikupe značajnu količinu podataka o klijentima. Ova značajna količina podataka donela je unosnu priliku za banke da prilagode svoju ponudu na način da je učine unosnijom za svoje klijente. Korišćenje BD može značajno da pomogne u smanjenju vremena usluge, poboljšanju kvaliteta usluga i osiguranju bezbednosti zainteresovanih strana (Gupta, Gupta, Agraval, & Kansal, 2019).

BDA se koristi u različitim sferama finansijskog sektora. Podržava ih da isporuče mnogo bolje rešenje svojim potrošačima, kako eksternim tako i internim. Banke iz različitih zemalja, kao što je Amerika, sada sprovode BDA i veštačku inteligenciju kako bi poboljšale svoje usluge (Radmehr & Bazmara, 2017). Američke banke koriste rešenja zasnovana na analitici da unaprede svoje proizvode, operacije i usluge. Bez implementacije ovakvih alata, banke možda neće uspeti da zadovolje potražnju potrošača, kao što se vidi u studiji. Banke moraju da modernizuju svoje tehničko znanje i da se koncentrišu na onlajn bankarstvo kako bi iskoristile prednosti ovih tehnologija. Ishod usvajanja tehnologije zavisi od nekoliko faktora uključujući, ali ne ograničavajući se na usvajanje znanja, implementaciju BDA alata, stalno poboljšanje načina da se bolje razumeju potrebe korisnika, fokusiranje na dugoročni cilj, naglasak klijenta. organizacione karakteristike, vrednost brenda, regulatorne sposobnosti i alokacije kapitala itd. (Mungai & & Baiat, 2018). Pre nego što krenu napred, banke moraju temeljno da istraže funkcije i tehnološke inovacije koje žele da pruže. Da bi rešila probleme i iskoristila priliku, svaka banka mora da traži korišćenje BDA.

Poznavanje BDA u bankarskom poslovanju poboljšava iskustvo potrošača na brojne načine. Ova analiza je procenila sentimentalnu i transakcionu procenu finansijskog sektora, a rezultati istih su istaknuti u nastavku: Studija je sagledala jedan od načina na koji se precizno zahvataju osećanja potrošača i koriste za procenu opšte ponude usluga, brzo rešavajući probleme kupaca. i obezbeđivanje zadovoljstva kupaca (Srivastava, Singh, Tanvar, & Tiagi, 2017). Sve u svemu, oduševljenje klijenta može rezultirati ne samo povećanom lojalnošću klijenata već i povećanjem prihoda za banke i finansijske institucije.

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Scientific review article

Banking 2022

Received: 26.03.2022
Accepted: 31.05.2022

DOI: 10.5937/bankarstvo2202147H

HOW BIG DATA ANALYTICS IS TRANSFORMING THE FINANCE INDUSTRY

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Summary

The data revolution happening throughout the world has brought transformation in the financial services sector. This vast information has opened doors to understanding the needs of the customers, finding insights, and lowering risks. In addition, it helps the financial services industry to take actions to improve clients' satisfaction at a faster rate than it was previously possible. Financial firms can develop new insights using BD because they can now collect a large volume of data about their customers, their spending pattern, and provide services that are beneficial, convenient, and quick for the customers. They can expand the use of those insights not only for their consumers but also for their internal process optimization, benefiting everyone in the process. While the impact of BDA on financial service companies is ubiquitous, not so many studies have been published to understand which aspects of the financial services industry could greatly benefit from the rise of technology and BDA. Few published studies address the challenges faced by banks in this technology era if they do not have BD tools implemented. This research covers data from banks from January 2019 to January 2022 to address that gap of a several banks from America and Europe that faced declining customer satisfaction. It uncovers the best methods used by financial firms globally to implement BDA to improve the services. This paper will also look at how BDA has been successfully used in the banking industry, regarding the following elements: consumer behavior, channels use, consumer spending pattern and profile creation, product cross-selling based upon user-profiling, analysis of feedback and sentiment, management of secure transactions, and fraud etc. This study helps find out and makes contributions on how the financial services industry, such as banks, could leverage BDA and provide superior services. Further research could be conducted across other players in the finance industry to learn about how they are impacted by the BDA.

Keywords: Big data analytics, Finance, Application, Banks, Machine Learning

Abbreviations: BDA - Big Data Analytics, BD - Big Data, CS - Customer Satisfaction

JEL classification: C55, G20, G21

Introduction

The data revolution has observed huge growth with financial companies. Even though the collecting of this information was impromptu, given that the financial system usually collects a lot of data, the opportunities opened by BDA surpasses any expectation previously anticipated of this historical record set. This information has also helped unlock secrets of cash moves, avoided risks, and understood consumer behavior. BD provides banks with the opportunity to extract valuable information from their customers and their own data more efficiently and quickly. Banks already reap the benefits of this.

A report by Munar et al. has discovered that companies in the financial services sectors that have implemented BDA have achieved more successes than others that did not use it (Munar, Chiner, & Sales, 2014). The benefit is not limited to the financial services industry, but all industries. BDA will not only support financial institutions to benefit from large volumes of data, but also help them get competitive upper hand, reduce costs, and transform challenges to opportunities. Banks are using BDA to develop insights and enhance capital management, capital allocation, and controlling resources. Research (Munar, Chiner, & Sales, 2014) found that 59.3% of financial and non-financial firms in America and Europe use BDA, and information analytics, demonstrating a major edge over the competition, and 91.2% think that a prosperous BDA application will determine the winners in the long run (Gupta, Gupta, Agrawal, & Kansal, 2019). But merely 32.3% of financial firms has developed a solid comprehension of BDA, and the remainder regularly focus on pilots and experiments with that (Gupta, Gupta, Agrawal, & Kansal, 2019).

While the use of BDA brings significant benefit to the worlds of business across any industry, many banks are still falling behind in terms of implementation of latest BD tools. Thus, some of them are failing to meet expectation of their customers. This study considers some such banks and evaluate how they could improve. The study makes significant contribution to understanding the challenges of lack of having a BD analysis method. The study also shows the benefits of having BDA tools.

Literature Review

What is BDA?

BD is defined as the vast growth and availability of data, both organized and unorganized (Gupta, Gupta, Agrawal, & Kansal, 2019). The author adds that BD is the sheer mass of data produced daily within global networks at a pace exceeding the capacity of current databases. (Bedeley & Iyer, 2014) described BD not only by the amount of information, but also by its variety, complexity, and speed by which the data must be analyzed or delivered; 3V is namely:

• Volume: Volume refers to the quantity of data beyond the ability to analyze through conventional tools, such as statistical analytical tools or standard analytical tools. (Hassani, Huang, & Silva,, 2018) adds that the sheer volume of stored data is rising rapidly, and (Indriasari, Gaol, & Matsuo, 2019) predicts that by 2022, there will be 90 zettabytes of data stored every year.

• Velocity: This is the speed of collecting data. Conventional intelligence applications use previous data from days, months, or quarters back, while BD relies on real time data to deliver insight rapidly. (Sproviero, 2020) states that the velocity of BD depends on not only the speed of the data flow, but also the pace at which it is collected, analyzed, and retrieved.

• Variety: BD accesses all sorts of information beyond the traditional structured and non-structured data and those stored in the data warehouse. It can also assimilate stored both structured and unstructured data provided by external sources (Amakobe, 2015).

(Radmehr & Bazmara, 2017) mentions that the ability to apply sophisticated algorithms and powerful computers to large data sets, revealing correlations and insights previously inaccessible through conventional data warehousing or BI tools, makes BD different from just "more data".

According to a new study by (Delgosha, Hajiheydari, & Fahimi, 2020), across different industries, including banking and financial services, have experienced the enormous potential offered by a combination of rise of technology and analytics. The report revealed that businesses need to adopt BDA to advance their offerings. A (Yu & Song, 2021) survey showed that 37% of organizations reported practicing advanced analytics, while 85% said they would be practicing within three years. (Gupta, Gupta, Agrawal, & Kansal, 2019) research adds that the rush to BDA is due to changes in the business environment and the need to seize more business opportunities. Advanced analytics has become the best way to discover new customer segments, identify suppliers, associate products of affinity and understand sales. (Sun, Morris, Xu, Zhu, & Xie, 2014) cited a survey of 550 decision-makers in businesses, who stated they adopted BD and analytics to improve customer acquisition, assist with new product development, and manage and gain a competitive advantage.

Firms such as Facebook have successfully gained a competitive upper hand, especially because analytics is the fundamental to the business environment, they operate in. According to (Srivastava, Singh, Tanwar, & Tyagi, 2017), Facebook has developed sophisticated profiles of consumers that help the organization target advertising with such precision that new rivals cannot even hope to catch up. Microsoft also, according to (Sproviero, 2020), has reinvented human resource management by using people analytics, forcing many organizations to realize that there is a new path to success.

BD allows financial firms to innovate on multiple fronts, bringing new products and services to market (Boumlik & Bahaj, 2017). Most of the products that financial firms offer allow them to collect data at great details about their customers, which in turn feeds the BDA tools used by them to improve the product further. Finance experts define BD as the tool which enables an organization to produce, manipulate and manage large information sets in a certain timeframe, as well as the storage required to support the amount of information characterized by variety, velocity, and volume (Munar, Chiner, & Sales, 2014). Our focus in this report is to examine the areas in which financial institutions use BD to improve their business risk management frameworks to improve executive, audit, and transparency oversight of risk (Mungai & & Bayat, 2018). One of the most important aspects of using BDA in financial firms is to reduce risks (Hassani, Huang, & Silva,, 2018). Here, the study will explore the methods in which data analysis is used to discover consumer behavior pattern by using BDA and detection of the correlation between monetary theft, and characteristics of the transaction and various transactions (Wong & Wong, 2020).

Problem Statement and Usage of BD

The study considers data from multiple banks across the USA and Europe. They were selected based on their declining customer satisfaction over a period of time. Most of these banks have been in operation for more than twenty years and have had difficulty reviving the profit margins after their post-2008 economic crisis. From 2012 onward, many of them began gathering as much data as possible from consumers to under different aspects of consumer spending. They also gathered consumer feedbacks to recognize and fix problems with all the issues of bank account holders. Some of them encountered a dip in their customer satisfaction measurement, together with dropping client retention. We collected data from banks to understand the following:

- Determining the real cause of reduction in client satisfaction across multiple banks
- Analyzing the spending patterns of the cardholders
- Channel use evaluation –Debit, and credit etc.
- Understand Consumer behavior

For our case, the following points are considered:

- Transactional details for cardholders (set of about 25,000 records), for time sequence January 2019 - Jan 2022.
- Accessed readily available to 25,000 files kept with a third-party management that banks use for gathering feedbacks.

Methodology

The study starts with analyzing the client satisfaction measurement. The data was collected from multiple banks across the world, from USA to Europe. The data is used to understand the consumer behavior, spending pattern and usage of banking services. The study also analyzes how the banks have used the BDA to address concerns of banking customers. Since a major portion of consumer facing role depends on services, the study will use a set of metrics to understand the quality of service provided by the banks and the speed at which the issues were resolved. This will help us understand whether the problems banks faced were due to poor services or maybe various other problems. Right after segmenting the problem with the feedback analysis, the study will try to find the explanation of why the matter occurred, as well as suggest improvements.

Findings and Analysis

Analysis of Responses

Feedback procedures are essential for every group to help you understand the likely areas of development. Of course, if done regularly, they help identify gaps in services rendered. Banks additionally started collecting responses from their customers; from people who visited bank limbs, and from people who utilized internet services.

Data Collection and Sample Size

The evaluation below is conducted utilizing the entire data collected, containing feedback from approximately 25,000 buyers. Following data was gathered and built up over two years. Customers accessing some banks have been asked to rate the bank anonymously on a scale of one-five on the following parameters:

- Is the buyer pleased with the quality of service?
- Is the buyer pleased with the speed of service?
- Are consumer queries addressed effectively?

Responses Analysis and Inference

The scores fell just before February 2019 are steady and slow. Program satisfaction, service quality, and handling velocity of queries have been almost all placed with the same weight. The clients ranked financial firms account products as normal, and also the financial firms account didn't occupy the remedial steps to enhance its customer ratings.

Figure 1: Feedback by different parameters

Nevertheless, between Jan 2018 and Mar 2019, "Service Quality" along with "efficient dealing with queries" have a low correlation = 0.401. That means the service quality was not correlated with the resolution of queries. During the same periods, "Quality of provided service" and "speed of providing service" have a great correlation = 0.692, showing that quality and speed of service were correlated, meanwhile the general score remained typical. It implies that the quality became an immediate manifestation of the velocity of quality service. If the pace of service has been enhanced, the clients perceived corresponding development within the quality of service. What this means is that people see pace as becoming a more important parameter. Speed and solution have low correlation of 0.365

Correlation	Quality	Solution	Speed
Quality	1,000	0,401	0,692
Solution	0,401	1,000	0,365
Speed	0,692	0,365	1,000

Table 1: Correlation

There are somewhat improvements within the method from January 2019 to April 2019. Infrequent surges make the finance firm require various steps to enhance the client satisfaction. If perhaps the study has a significantly simpler look into the three weeks Apr 2019 - June 2019, it is found that the regular buyer makes at least three transactions in some period of the day. The other section of the study will try and isolate the real cause of the drop in client satisfaction ratings for banks and evaluate and look at different strategies utilized in analytics. As stated before, the following will be the foundation of the part of the study: the banks' dataset includes the transactional history of cardholders from January 2019 – Jan 2022 and shall also be examined as per the heads provided below.

Transaction Pattern
Let us have a glimpse at the common card use per month every season, with the time sequence from 2019 - 2022. The study will analyze the web transaction with cards and examine the fads in credit patterns and debit patterns of our cardholders.

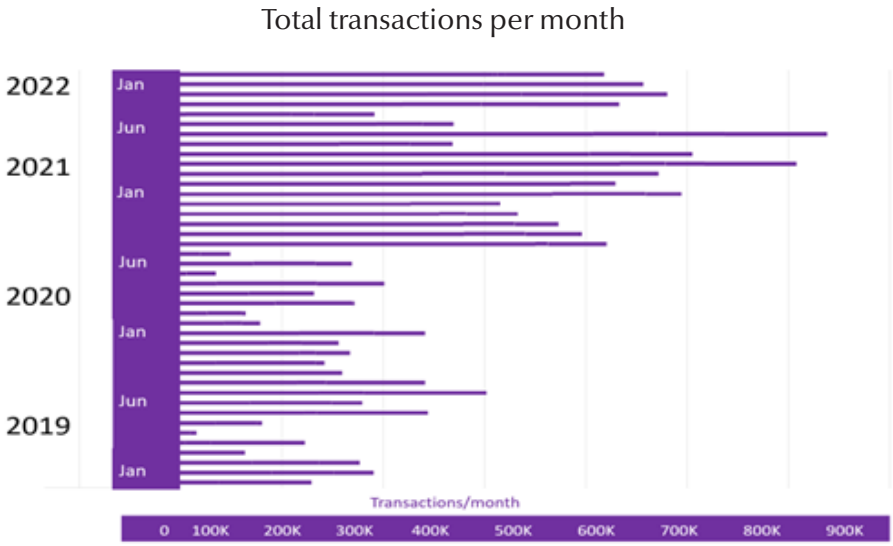

Table 2: Total transactions per month in the banks

Observations: As the study finds, there continues to be a rise in cash distributed through 2019 to 2022. The study also observes that for many cards, even though the cash transaction volume has improved, it is remained consistent for other people. There are several cards that exceeded total amount of transactions than the other methods, so that the net spending of theirs was much more than total earnings during that time.

Total Debit Transactions

Observations: There continues to be a gradual rise in total cash flowing directly into accounts. This goes in sync with how value of financial assets increases with time for almost any financial institution. For card holder accounts, there is an obvious increase of cash received each month.
Inference: This card holder might be a normal salaried individual, with an annual rise in their take-home income. The variations in the credit could be due to an adjustable component in the income, but the fundamental wage would have improved in this instance. Identification of healthy normal salaried card holders could additionally profit the banks, as these card holders may be approached with more desirable savings, liability goods and systems. Rest of the card slots might be contractual personnel, or maybe have staggered energy sources of income. Identification of non-salaried card holders can help banks develop and provide goods like small savings programs, as well as fixed deposit programs with attractive returns.

Total Credit Transactions

Observations: There is an easy rise in total credit every account every month every year. There is probable seasonality in the spending patterns. Many factors may influence this, like macro-economic conditions, festive seasons, income resources of the entities under observation and spending practices of the entities under observation.
Inference: Such consumers could greatly benefit from a credit card offering, allowing them to spend more to fulfill their needs during different occasions, while also allowing more transaction for the banks. The customer also remain loyal to the bank if the customer's requirements are met.

Consumer Behavior Analysis Based on Channel Use Analysis

The dynamics of transactions are considered an important parameter for knowing the requirements and habits of a client. Following transaction sorts are looked at for the case like Credit Transaction, and Debit Transaction.

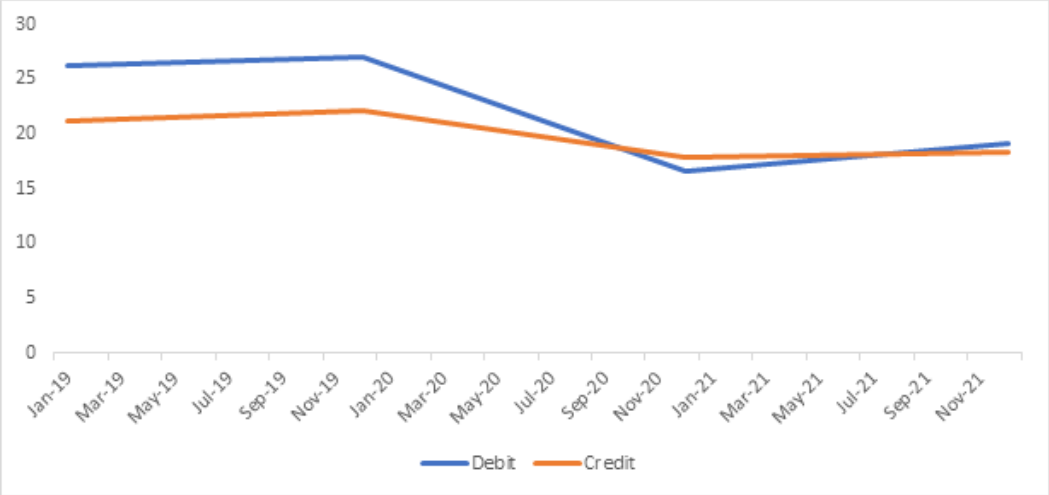

Table 3: Channel usage

Observations: Based on the usage of debit and credit cards, it's observed that debit transactions are usually higher than that of credit transactions per user. As seen in the graph above, debit transactions frequency is usually around 20% higher. However, due we also observe an interesting phenomenon where the credit card transactions almost became equal to debit card transactions, mostly because debit card transaction frequency fell. Due to the timing, we estimate that it was due to Covid-19's impact of people's reduced earnings, resulting in people using credit cards more often. That continues till the end of 2021 when covid's related closure's reversed and businesses opened more, resulting in people earning more and thus using debit cards more often.

Consumer Behavior Analysis Dependent on Consumption Patterns for Cross Selling

The study can also use the transactional information to estimate which consumers can be sold what kinds of financial products. It is also used by banks to segment and target prospective clients. Below is the compilation of information from our dataset, for the dataset of ours, for the goal of knowledge customer behavior for cross selling and up-selling financial items to clients.

Observations: The graph above shows the optimum debit and highest credit patterns for the cardholders. As noticed, with change for timeline, usage of these cardholders increases, and that boosts their investing power; and, as their spending capacity increases, the extended debit card spending additionally improves. Not just the spending amount increases of theirs, but additionally the spending frequency increases of theirs. Based on customer behavior analysis, the study can infer the following - This individual has a capacity to invest, and though occasionally, they are invested much more than what is acknowledged, to the account of their spending throughout specific times. And so, this person is the perfect candidate for prospective loan applicants. This person additionally shows that as their capacity to invest increases, the online debit additionally increases. Thus, this individual is additionally a perfect choice for using a credit card. They can be offered a charge card, or depending on whether They is today using one, the credit limit of their may be increased. Credit card linked provides could be extended to this individual, since They is much more likely to use the card of theirs.

Security and Fraud Analysis

Based on historical transactions and consumption capacity of clients, the behavioral analysis can help us expose a possible threat and uncover frauds which may have occurred in the past. If a customer has been observed to have engaged in excessive transactions to questionable accounts, they can be flagged, and further inquiries can be made to ensure proper use of financial resources. If a customer has conducted fraudulent activities in the past, their transfers could be flagged until proper action is taken to address any concern. That way, banks can ensure that the entities the customers are dealing with are protected and so are the customers from fraudulent entities.

Net Debit Transaction Counts per Month Every Year

When the study looks at the debit transactions which occurred during the same period, it results in several intriguing results. Below will be the plot of all total debit transactions for respective card holders. Observations: Net transactions' count grows with time and subtly. Banks can use the data to understand issues such as sudden spikes like this can be used for illegal transactions and may also suggest the product could be compromised. It clearly suggests unauthorized access and misuse of money by dishonest agents.

Transaction Time Trend Analysis for 2021

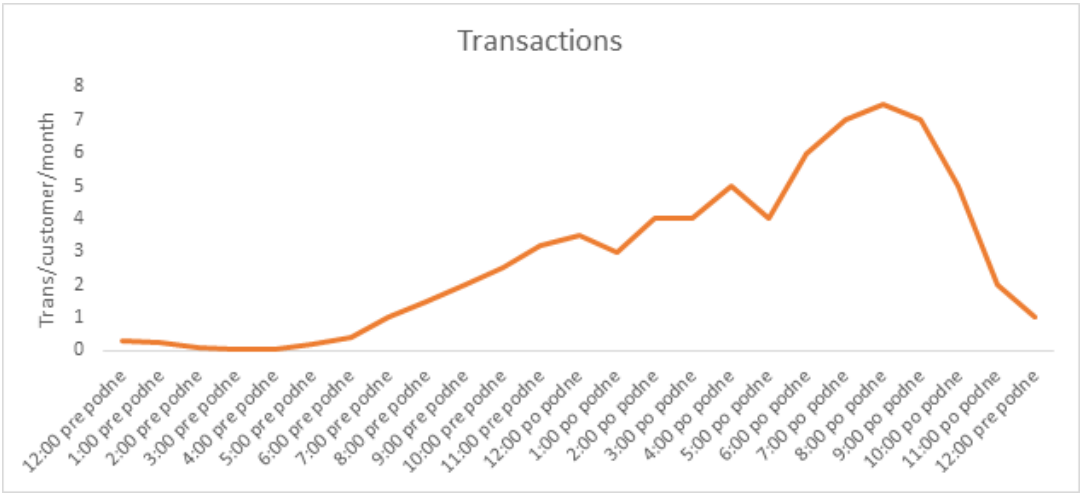

Table 4: Transaction trend

Observations: In common, card transactions are expected to take place between 08:00 and 23:00, since that is the period inside which regular companies work. Starting from midnight to early in the morning, we see fewer transactions, which shows that the users do not use the payment methods that much as it gets late at night. However, starting around 06:00, we observe a growing number of transactions, as expected, and it peaks around 20:00, where people might be using their cards for different purposes like buying at stores or at restaurant.

Correlation Between Observations

One of the banks we have studied faced downtime due to technical glitches during period of the study and we collected the client satisfaction for that specific bank on that day and compare it with normal days.

Client satisfaction analysis: In the early hours of the morning, the bank encountered a cyber-attack during which cards were used for making purchases. The hacking activity paused after 16th May 2021 and consequently ceased to exist around 10th June 2021. Almost instantly, the client satisfaction measurement list for the bank decreased by three indices. What this means is the problem happened at a widespread level, and customers were impacted in large numbers. Bank employed improved the protection of the internet system to avoid even more fraud transactions. This is apparent from the reality that no fraud transactions were found following the event. Bank also worked towards pacifying the stressed buyers, and also did activities regarding brand damage control. This is additionally apparent from the reality that the client satisfaction measurement list is rising steadfastly after the incident and has maxed out the degree pre-May 2021.

Future Research Scope

The study could be extended to test and quantify the financial and non-financial advantages that banks received after the introduction of BDA and forecast improvements in the bank is financial statements. The work may also be expanded to include the different data collection methods that banks can use to improve analysis quality. Some additional scope of research could be the usage pattern of specific financial instrument considering BDA, such as mortgage-backed securities, home loans etc., that have wide implications in finance and are greatly impacted by the use of BDA.

Conclusion

The rise of technology has enabled financial institutions to gather significant amount of data about customers. This significant volume of data has brought a lucrative opportunity for banks to customize their offerings in a way to make it more lucrative for their customers. Using BD can significantly help reduce service time, improve quality of services, and ensure safety of the stakeholders (Gupta, Gupta, Agrawal, & Kansal, 2019).

BDA is used throughout different spheres of the financial sectors. It supports them to deliver much better solution to their consumers, both external and internal. Banks from different countries, such as America, is now carrying out BDA and AI to improve their services (Radmehr & Bazmara, 2017). The American banks are using analytics-based solutions to enhance its products, operations, and services. Without implementation of such tools, banks might fail to meet the consumer demand as seen in the study. Banks must modernize their technical knowhow, and concentrate on online banking, to take advantages of these technologies. The outcome of technology adoption depends on several factors including but not limited to the adoption of the know-how, implementation of BDA tools, constantly improving ways to understand the customer needs better, being focused on the long-term objective, client emphasis. organizational features, brand value, regulatory abilities, and capital allocations etc. (Mungai & & Bayat, 2018). Before moving forward, banks must thoroughly investigate the functions and technological innovation they wish to provide. To fix the troubles and to grab the opportunity, each bank must seek usage of BDA.

Knowledge of BDA in banking business improves consumers' experience in numerous ways. This analysis assessed sentimental and transactional evaluation on the financial sector, with the results of the same being pointed out below: The study viewed one of the ways precisely how consumer sentiments are seized and used to evaluate the general service offering, solving customers' issues rapidly and ensuring customer satisfaction (Srivastava, Singh, Tanwar, & Tyagi, 2017). Overall, delighting a customer can result in not only increased customer loyalty but also increased revenue for banks and financial institutions.

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