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TITLE IX AND EMERGING COMMERCIAL IMPLICATIONS

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ABSTRACT

Title IX of the Education Amendments of 1972 significantly expanded athletic participation opportunities for women and girls, yet persistent disparities remain in secondary school athletics. While Title IX's substantive standards apply equally across educational contexts, enforcement mechanisms differ in important structural respects. In higher education, the Equity in Athletics Disclosure Act (EADA) requires annual, gender-disaggregated reporting of athletic participation and expenditures, creating a standardized transparency regime that renders compliance publicly observable. No comparable federal disclosure framework governs K–12 athletics. As a result, enforcement at the secondary level often depends on complaint-driven investigations rather than routine, systematic reporting.

This paper argues that the central challenge in secondary Title IX implementation is not doctrinal ambiguity but enforcement infrastructure. Drawing on regulatory governance scholarship, it contends that transparency functions as a foundational condition for meaningful accountability by reducing informational asymmetries and enabling evaluative oversight. Although secondary schools participate in the Civil Rights Data Collection (CRDC), that system differs from EADA in frequency, granularity, and public comparability, limiting its capacity to function as a continuous transparency mechanism.

The contemporary expansion of Name, Image, and Likeness (NIL) rights further underscores the significance of this structural gap. While NIL compensation falls outside traditional Title IX proportionality analysis, access to emerging commercial opportunities depends in part on developmental pathways established during secondary education. The paper proposes scaled, district-level reporting and verification mechanisms designed to strengthen accountability without fundamentally altering Title IX's doctrinal framework. By reframing transparency as enforcement infrastructure, this analysis advances a governance-based approach to equity in high school athletics.

TITLE IX OF THE EDUCATION AMENDMENTS OF 1972

Title IX of the Education Amendments of 1972 stands as one of the most significant civil rights statutes in American education. By prohibiting sex-based discrimination in any educational program or activity receiving federal financial assistance, including athletics (20

U.S.C. § 1681), Title IX transformed opportunities for women and girls nationwide. In athletics alone, the impact has been profound. The proportion of girls participating in high school sports has increased from approximately 7.4% in 1971 to more than 42% today (Cramer, 2022; Women's Sports Foundation, 2022). These gains reflect the power of a clear statutory mandate, reinforced through agency guidance and judicial interpretation (U.S. Department of Health, Education, and Welfare, 1979).

Yet the persistence of gender disparities in secondary school athletics suggests that formal legal standards do not guarantee uniform implementation. While Title IX's substantive requirements apply equally across educational contexts, enforcement mechanisms differ in important structural respects. In higher education, the Equity in Athletics Disclosure Act of 1994 (EADA) requires colleges and universities receiving federal funds to publish annual, gender-disaggregated data on athletic participation and expenditures. Although disclosure does not itself ensure compliance, it establishes a standardized transparency regime that renders participation patterns and resource allocation publicly observable.

No comparable federal reporting requirement governs K–12 athletics. As a result, disparities at the secondary level often come to light only through litigation, complaint-driven investigations, or investigative reporting (Newhouse, 2022; Shirley Povich Center for Sports Journalism & Howard Center for Investigative Journalism, 2022). This difference does not alter Title IX's doctrinal framework, but it affects how compliance is monitored and evaluated. Where structured transparency is absent, inequities may be slower to detect and more burdensome to challenge.

The significance of this enforcement asymmetry is heightened in the contemporary athletic environment. The recent expansion of Name, Image, and Likeness (NIL) rights following regulatory reform and judicial clarification has introduced new commercial dimensions to athletic participation (NCAA, 2021; *National Collegiate Athletic Association v. Alston*, 2021). Although NIL compensation falls outside traditional proportionality analysis under Title IX, access to collegiate athletics—and the market opportunities increasingly associated with it—depends in part on developmental pathways established during secondary education.

This paper argues that the central challenge in secondary Title IX implementation is not doctrinal ambiguity, but enforcement infrastructure. The absence of routine, standardized transparency mechanisms at the K–12 level represents a structural gap in the informational architecture necessary for meaningful accountability. By contrasting postsecondary disclosure requirements with the largely reactive enforcement model in secondary education, this paper contends that transparency should be understood not as a policy preference, but as a foundational condition for enforceable equity.

HISTORICAL BARRIERS FACED BY WOMEN IN ATHLETICS

To fully understand contemporary gender equity issues in athletics, it is crucial to examine the historical experiences and systemic barriers faced by women athletes. Title IX dramatically advanced women's opportunities in athletics, but these gains followed decades of

institutional resistance and cultural challenges. Tracing the history of women's participation in sports provides important context for the persistent inequities addressed throughout this paper.

The first intercollegiate competition for women was a scheduled tennis tournament between Bryn Mawr College and Vassar College. It was canceled, however, because the Vassar faculty did not allow their women athletes to participate in competition between colleges (Swanson & Spears, 1995). Women were not active in intercollegiate sports until basketball was introduced at Smith College in 1892 (Weight & Zullo, 2015). In fact, the first competition for women's intercollegiate athletics occurred in 1896, when Stanford University's women's basketball team defeated the University of California, Berkeley (Swanson & Spears, 1995).

In 1929, the Carnegie Foundation, a private organization that studies and recommends education policy, published *American College Athletics*, a 350-page report that accused many schools of recruiting athletes, giving them cushy jobs and paying them. The report, which is based on three years of work and more than a hundred campus visits, concluded that in its current form, college athletics posed a threat to education because they are "profoundly deleterious" to high school students and "its influence upon the nature and quality of American higher education has been no less noxious" (Savage, 1929, p. 240).

Women's physical educators were aware of the problems and criticisms surrounding men's intercollegiate athletics. They were determined to keep athletics in an educational environment for women. The physical education faculty did not want to lose control over their programs, as they perceived that the men had done. In the 1920s, the Women's Division of the National Amateur Athletic Federation (NAAF) was formed to organize intercollegiate competition among women (Bell, 2008).

Events of the 1950s and 1960s, including the Civil Rights Act of 1964, feminist activism, and the debate over the Equal Rights Amendment, raised awareness of collegiate women seeking greater athletic opportunities. In 1966, the Division for Girls and Women in Sport established a Commission on Intercollegiate Sports for Women (CISW) to assist with athletic competitions for women, renamed the Commission on Intercollegiate Athletics for Women (CIAW) the following year. In 1969, national championships in gymnastics and track and field sports were organized. Championships for swimming, badminton, and volleyball followed in 1970. In 1972, the same year that Title IX was enacted, a collegiate women's basketball championship was added.

Moreover, in 1971, the CIAW was replaced by the Association for Intercollegiate Athletics for Women (AIAW), "setting the stage for the struggle to control women's athletics in the 1970s between the AIAW and the NCAA" (Bell, 2008). The AIAW membership consisted of 278 charter institutions. By 1981, membership exceeded 800 institutions. Its mission was to "lead and conduct programs at the collegiate level that were competitive for women" (Bell, 2008). "The AIAW focused on education, not athletic performance, and thus rejected the 'win or die' attitude of the NCAA. Instead, the AIAW emphasized participation in sport as the most important aspect and deemphasized winning" (Bell, 2008).

However, given the growth of women's athletics and considering the increased financial base and political power it could gain from exerting control over women's intercollegiate athletics, the NCAA set out to force the AIAW out of control (Hult, 1994). The NCAA formed its own NCAA Women's Committee to absorb the AIAW while offering women's

championships outside the AIAW to link institutions to the NCAA (Carpenter, 1993). The NCAA had never shown an interest in women's athletics before Title IX because there was nothing that required female participation at the national level. Thus, it chose not to pursue women's athletics (Bell, 2008). "The formation of this committee was politically significant because prior to this time, the NCAA had demonstrated no interest in taking responsibility for women's sports" (Carpenter, 1993, p. 83).

The NCAA's next move was to introduce women's championships and offer institutions sponsoring women's sports, a proposition that would ultimately lead to the demise of the AIAW. The NCAA, having committed three million dollars to the effort, offered the following: (a) pay all expenses for teams competing in a national championship; (b) charge no additional membership fees for schools to add women's programs; (c) create financial aid, recruitment, and eligibility rules that are the same for women as for men; and (d) guarantee that women have more television coverage (Bell, 2008). The AIAW responded by suing the NCAA for violation of the Sherman Anti-Trust Act, but the lawsuit was not successful, as the courts ruled that the market for women's athletics was open to competition and, therefore, that no anti-trust laws had been violated (Bell, 2008). The AIAW could not compete with the NCAA inducements, and the loss of membership, income, championship sponsorship, and media rights forced the AIAW to cease operations on June 30, 1982 (Festle, 1996).

With women's athletics under its control, the NCAA turned its attention to Title IX. Specifically, it lobbied for the exclusion of college athletic departments from the Title IX jurisdiction because most athletic departments do not directly receive federal funding. In 1984's *Grove City College v. Bell*, the U.S. Supreme Court removed intercollegiate athletics from the jurisdiction of Title IX, implementing what is known as the programmatic approach to Title IX (Cotten & Wilde, 1997).

Four years later, in 1988, President Reagan vetoed the Civil Rights Restoration Act, a legislative response to the Supreme Court's decision in *Grove City College v. Bell* (1984). In *Grove City*, the Supreme Court had limited Title IX's applicability exclusively to specific programs directly receiving federal funds, an interpretation known as the "programmatic approach." Congress strongly opposed this narrow interpretation and asserted through the Civil Rights Restoration Act that Title IX compliance should apply institution wide. Consequently, Congress overrode President Reagan's veto, firmly establishing the "institutional approach," whereby any federal funding to an educational institution triggers Title IX compliance obligations throughout the entire institution. This broader interpretation ensured that Title IX protections extend comprehensively to all educational programs and activities within funded institutions, an approach that remains in effect today (Cotton & Wilde, 1997).

These historical struggles within collegiate athletics underscore broader systemic inequities that begin at the secondary education level. Since many female athletes first encounter unequal treatment during high school, achieving gender equity in collegiate sports requires addressing these foundational disparities through focused reforms in secondary education.

THE ISSUE OF FUNDING

In 2023, the U.S. Department of Education Office for Civil Rights (OCR) filed a complaint against the Phoenixville Area Schools District (PASD) because it failed to provide gender equitable opportunities and treatment to girls participating in varsity athletics. The complaint alleged that boys received preferential treatment by being assigned to better facilities for practices and for games and that boys received more practice gear and equipment than female athletes in the same sport did (Staurowsky, 2024). The complaint further suggested that, on average, PASD spending on boys' baseball was 27% greater than that on girls' softball, 30% greater for boys' soccer than for girls' soccer, and 33% greater for boys' basketball than for girls' basketball (Staurowsky, 2024). This case reflects broader national trends where female athletes, despite the legal protection of Title IX, continue to face structural barriers that limit their ability to compete on equal footing. Even in the face of Title IX, the case highlights how schools can circumvent compliance by prioritizing boys' sports with respect to funding, facility access, and institutional support. A lack of oversight and enforcement mechanisms for high schools at the federal and state levels can lead to schools failing to fully uphold equity in sports.

The importance of funding and equity in opportunity is exacerbated through the findings of research conducted by Hextrum et al. (2024). Their study underscores the persistent inequalities in high school athletics, revealing that access to sports is shaped not only by gender but also by race, ethnicity, and socioeconomic status. Their mixed methods study of over 4,000 high school student athletes examined how structural barriers impact girls' participation and persistence in sports. Their findings show that predominantly white high-income families are more likely to have the resources to enroll their daughters in competitive sports at an early age, providing them with access to elite training programs, private coaching, and well-funded schools. Girls from lower-income backgrounds, especially from Black and Latina communities, are systematically routed away from high school sports due to financial constraints and fewer sports offerings in underfunded schools. Schools in wealthier, majority-white schools tend to have more sports programs, superior facilities, and better-funded teams than those in lower-income, racially diverse areas.

The study also revealed that girls are disproportionately funneled into a narrow range of sports, such as basketball and track, whereas high-cost, lower-access sports, such as swimming, tennis, and rowing, remain dominated by white, upper-middle-class girls. Furthermore, boys' sports teams, particularly in revenue-generating sports such as football and basketball, receive disproportionate funding and school support, making it even more difficult for girls' programs to compete for funding. The failure to enforce Title IX at the high school level allows these disparities to persist, as schools often skirt compliance in ways that help maintain these historical socioeconomic inequities. Without stronger federal and state oversight, particularly in the monitoring and enforcement of financial equity, Title IX remains an incomplete solution.

ASSESSING GENDER EQUITY IN ATHLETICS

Over the past decade, lawsuits filed by high school female athletes have exposed long-standing inequities in secondary school athletics—issues that have persisted far longer than the litigation itself. To better categorize the common forms of discrimination faced by female athletes in these settings, we can refer to the U.S. Department of Education’s Policy Interpretation: Title IX and Intercollegiate Athletics, which provides a structured compliance assessment framework:

5. Application of the Policy—Levels of Competition.

In effectively accommodating the interests and abilities of male and female athletes, institutions must provide both the opportunity for individuals of each sex to participate in intercollegiate competition, and for athletes of each sex to have competitive team schedules which equally reflect their abilities.

a. Compliance will be assessed in any one of the following ways:

(1) Whether intercollegiate level participation opportunities for male and female students are provided in numbers substantially proportionate to their respective enrollments; or

(2) Where the members of one sex have been and are underrepresented among intercollegiate athletes, whether the institution can show a history and continuing practice of program expansion which is demonstrably responsive to the developing interest and abilities of the members of that sex; or

(3) Where the members of one sex are underrepresented among intercollegiate athletes, and the institution cannot show a continuing practice of program expansion such as that cited above, whether it can be demonstrated that the interests and abilities of the members of that sex have been fully and effectively accommodated by the present program.

(<https://www.ed.gov/sites/ed/files/about/offices/list/ocr/docs/titleix-summary.pdf>)

Commonly referred to as the three prongs—Substantial Proportionality, History and Continuing Practice of Program Expansion, and Full and Effective Accommodation—these standards address specific forms of discrimination that can be broadly categorized as issues of equity, effort, and unmet interest, respectively.

SUBSTANTIAL PROPORTIONALITY

The proportionality prong of Title IX requires that schools provide athletic opportunities to male and female students in a manner that is proportionate to their representation in the

student body. When significant disparities exist, particularly with underrepresented genders, schools may fail to meet the substantial proportionality requirement of Title IX.

In Mt. Diablo (2024), College Park High School (CPHS) reported that girls made up 47% of the student body, while boys represented 53%. However, only 42% of the athletic participation slots at CPHS were afforded to girls. This results in a 5% participation gap between female student enrollment and athletic participation. For Title IX compliance under substantial proportionality, CPHS would need an additional 95 female athletes to meet the gender-equity standard. This indicates a significant gap between the opportunities provided to male and female athletes, as the school fails to offer an equal share of athletic participation to female students in proportion to their overall enrollment (Mt. Diablo, 2024, p. 5).

The failure to meet proportionality is evident in the disparities between male and female athletes' access to athletic facilities. Male athletes at CPHS enjoy well-maintained, conveniently located facilities, such as the baseball field, which is equipped with modern amenities like covered dugouts, storage, a snack shack, and spectator seating. In contrast, female athletes, particularly those on the softball team, are relegated to a poorly maintained and remote field that lacks basic facilities such as storage, restrooms, and adequate seating. The disparity in facilities underscores the unequal treatment of male and female athletes and further reflects the failure to provide equal athletic opportunities (Mt. Diablo, 2024, pp. 1-2).

The disproportionality also extends to practice conditions. Female athletes at CPHS face limitations in their access to turf fields, as they primarily practice on grass. This restriction puts them at a competitive disadvantage, particularly when competing against teams with regular access to turf fields for both practice and games. This inequity highlights the broader issue of limited resources allocated to female sports programs, which contributes to the overall participation gap between male and female athletes (Mt. Diablo, 2024, p. 11).

The inequity in athletic opportunities and resources is not unique to CPHS. In *A.B. by C.B. v. Hawaii State Department of Education* (2019), the Department of Education (DOE) was found to be in noncompliance with Title IX due to substantial discrepancies in athletic participation rates. While female students constituted nearly 48% of the student body, they accounted for only 40% of athletic participants. This nearly 8% participation gap reflects a systemic issue where female students are systematically excluded from hundreds or thousands of athletic opportunities available to their male counterparts, further illustrating how schools fail to meet the proportionality standard in practice (AB by CB, 2019, p. 11).

Female athletes at James Campbell High School (JCHS) faced severe inequities in both facilities and resources. They lacked basic amenities such as full-sized lockers, showers, bathrooms, and air conditioning. In contrast, male athletes had access to a stand-alone athletic locker room. Female athletes were often forced to change in public spaces, including under bleachers or in teacher closets, which compromised their privacy and dignity. The DOE's Master Plan for Athletic Facilities prioritized upgrades to the male baseball field before addressing the need for a female athletic locker room, underscoring the systemic neglect of female athletes' needs (Plaintiff Complaint, 2018).

Furthermore, female athletes were provided with inadequate equipment and practice facilities. The female softball team lacked a batting cage or dedicated facility, relying on a poorly

maintained storage container that was often damaged by weather. Similarly, female water polo players were forced to practice in the ocean due to the lack of a regulation pool. The DOE's failure to provide essential facilities and equipment for female teams exemplifies the ongoing disregard for their athletic needs (Plaintiff Complaint, 2018).

In addition to inadequate facilities, female athletes also experienced a lack of dedicated coaching and resources. Some girls' teams had no coach at all, while male sports programs were more adequately staffed and funded. For example, the female water polo team had no official coach, forcing a parent with no experience in the sport to step in. This lack of trained coaching staff severely hindered the development of female athletic programs and perpetuated the inequity in opportunities for girls (Chen, 2022; Plaintiff Complaint, 2018).

Female athletes at JCHS also faced discrimination in scheduling and travel opportunities. Boys' teams were given prime Friday evening slots for games, attracting larger crowds and greater exposure, while girls' teams were scheduled during less favorable times, such as Tuesdays and Thursdays, leading to lower attendance and community support. Travel opportunities were disproportionately allocated to male sports teams, and girls' programs had limited access to off-island competitions and athletic enrichment (ACLU, 2018).

The disparity also extended to promotion and publicity, where boys' sports received far more extensive promotion than girls' sports. The school's website featured numerous photo albums dedicated to boys' teams but none for girls' teams. This unequal promotion contributed to a sense of neglect and undervaluation of female athletes, reinforcing the gender disparity in athletic opportunities at JCHS (ACLU, 2018).

Similarly, *Ollier v. Sweetwater* (2014) provided further evidence of disproportionality, particularly at Castle Park High School, where the percentage of female athletes ranged from 33.4% to 40.8% from 1998 to 2008, despite females comprising nearly half of the student body. At no point in the ten-year period did the disparity fall below 6.7%. In the 2007–2008 school year, this gap represented 47 girls who would have participated in sports if participation had been proportionate to enrollment. The court noted that these 47 girls could sustain at least one competitive team, yet Sweetwater failed to provide enough opportunities to meet the proportionality standard (*Ollier v. Sweetwater*, 2014, pp. 12–13).

In all three cases, the disparities in athletic participation between male and female students highlight the failure of schools to meet the proportionality requirement of Title IX. Schools must evaluate and address the interests and abilities of underrepresented genders to ensure that athletic opportunities are provided in numbers that are proportionate to their representation in the student body. Without proactive measures to close these gaps, schools continue to fall short of the equity standards set forth by Title IX.

HISTORY AND CONTINUING PRACTICE OF PROGRAM EXPANSION AND FULL ACCOMODATION OF STUDENT INTERESTS

Title IX requires schools to demonstrate consistent efforts in expanding athletic opportunities to underrepresented genders over time. Schools must show that they are proactive in adding new sports or teams to meet the growing interests and abilities of that gender,

particularly when proportionality standards are not met. Failure to do so undermines compliance with the law.

In *Mt. Diablo* (2024), College Park High School (CPHS) added flag football for girls in the 2023–2024 school year after it was approved as an interscholastic sport by the CIF. Despite over 40 girls expressing interest in playing competitively, the district refused to establish a junior varsity team, leaving only 33 girls on the final roster. This roster, which could have supported over two full teams, sharply contrasts with the boys' three football teams—varsity, junior varsity, and freshman/sophomore—accommodating 98 male players. This disparity highlights the failure of the district to meet the demonstrated interest of female students despite their willingness to participate, demonstrating that CPHS has not taken the necessary steps to expand opportunities for girls in athletics (*Mt. Diablo*, 2024, p. 5).

Furthermore, a gender disparity is evident in coaching opportunities at CPHS. During the 2022–2023 school year, CPHS employed 85 male coaches, none of whom coached girls' teams, while only 28 female coaches were employed, seven of whom coached boys' teams. None of the female coaches were on-campus coaches, while seven male coaches were. This resulted in a ratio of one coach for every seven male athletes compared to one female coach for at least every 16 female athletes. This disparity in the availability of on-campus coaches significantly limits coaching opportunities for female athletes, perpetuating the gender imbalance in CPHS's athletic programs (*Mt. Diablo*, 2024, p. 14).

In *AB by CB* (2019), the plaintiffs accused the Department of Education (DOE) of failing to take sufficient proactive steps to address gender inequities in athletic participation. Despite numerous complaints from students and parents, the DOE and Campbell administrators allegedly retaliated by threatening to cancel the girls' water polo team and forcing the team to resubmit their program paperwork after a heated meeting between the athletes, parents, and the administration. The plaintiffs contended that the administrators' refusal to establish equitable programs, despite clear interest from the students, demonstrated a deliberate attempt to suppress the growth of female athletic opportunities (*AB v. CB*, 2019, p. 3).

Similarly, in *Ollier v. Sweetwater* (2014), the district court found that female athletes at Castle Park High School were often supervised by overworked coaches, further contributing to the lack of support and opportunities available to them (*Ollier v. Sweetwater*, 2014, p. 10). The court also ruled that Sweetwater violated Title IX by retaliating against the plaintiffs after a complaint regarding inequalities in the school's athletic programs. The retaliation included firing the Castle Park softball coach, Chris Martinez, and replacing him with a less experienced coach. Additionally, the plaintiffs suffered from the cancellation of their annual awards banquet and were denied participation in a Las Vegas tournament that could have provided exposure to college recruiters. These actions disrupted the softball program, and the court noted that the retaliatory actions could be linked to the plaintiffs' protected conduct through circumstantial evidence (*Ollier v. Sweetwater*, 2014, pp. 10–11). The case also revealed that Castle Park cut its field hockey team, not due to waning student interest, but because the school could not find a coach. The court emphasized that the inability to hire a coach did not reflect a lack of student interest, further highlighting Sweetwater's failure to respond to the growing interest in sports among female athletes (*Ollier v. Sweetwater*, 2014, p. 14).

These cases underscore the necessity for schools to actively expand athletic offerings for underrepresented genders, especially in response to growing student interest and evolving needs. Schools must take proactive measures to add new teams and sports based on student interest, ensuring equitable opportunities for all students. Title IX requires schools to assess and respond to the interests and abilities of underrepresented genders, rather than dismissing or ignoring their expressed desires for participation in athletics. These cases also are unique because most Title IX cases involve higher education, not K-12. Although the Equity in Athletics Disclosure Act of 1994 requires coeducational postsecondary institutions that receive federal funding to publish data on gender equity on their athletic programs, there is no comparable federal law for the K-12 level.

FEMALE ATHLETES' EXPERIENCES UNDER TITLE IX

While Title IX is often heralded as a landmark victory for gender equality in education, the reality of its implementation in high school athletics reveals a more complicated—and incomplete—story. According to the Women's Sport Foundation (2022) in 1971–72, just 294,015 girls participated in high school varsity sports compared to 3.67 million boys. By 2018–19, girls' participation had grown to over 3.4 million, a remarkable increase that suggests significant progress. Yet during the same period, boys' participation also increased to 4.53 million, leaving a gap of more than one million opportunities that girls have yet to close. This persistent disparity highlights a troubling truth: despite legal mandates, institutional structures and cultural barriers continue to limit access, resources, and support for female athletes.

A critical dimension in assessing the impact of Title IX lies in understanding how female athletes perceive the equity it is intended to ensure. In their study of collegiate student-athletes, Druckman, Rothschild, and Sharrow (2018) explore how exposure to Title IX and perceptions of gender equity shape political attitudes and behaviors. Their findings reveal that although most athletes—regardless of gender—support the principle of equitable treatment in athletics, many, particularly female athletes, perceive persistent disparities in the actual distribution of resources such as scholarships, facilities, and coaching. These perceived inequities not only influence athletes' beliefs about fairness in sport but also heighten their willingness to engage in political advocacy for greater equity. The authors begin by asking respondents whether resources should be distributed equally between women and men. The majority agree that neither gender should be advantaged when it comes to overall resources, opportunities, staffing, or equipment. However, when asked about actual resource distribution, the results suggest a widespread belief that men are currently advantaged in all four categories.

While Druckman, Rothschild, and Sharrow (2018) demonstrate that female collegiate athletes perceive persistent inequities despite broad support for gender equity, similar disparities are evident at the high school level. For example, in a Title IX lawsuit against the Red Bluff Joint Union High School District in Northern California, female athletes alleged unequal access to athletic opportunities, facilities, and resources compared to their male counterparts (*T.S. ex rel. Struthers v. Red Bluff Joint Union High Sch. Dist.*, June 27, 2017). Despite comprising more than half of the student body, girls had significantly fewer team slots, nearly 200 fewer than

boys, resulting in a 14.9% participation gap (Legal Aid at Work, 2017). In addition to reduced opportunities, female athletes cited inferior treatment in areas such as field quality, locker rooms, and equipment access. The lawsuit led to a settlement requiring the district to increase sports participation opportunities for girls, improve facilities, and ensure equitable budgeting and resource allocation. The agreement included federal court monitoring and a Title IX consultant to oversee implementation (*T.S. ex rel. Struthers v. Red Bluff Joint Union High Sch. Dist.*, July 10, 2017). A lawyer for plaintiffs noted that the litigation revealed that almost all high schools are out of compliance with Title IX by not providing girls with equal participation and benefits (Legal Aid at Work, 2017).

These inequities are not isolated incidents but reflect a broader national pattern of systemic noncompliance with Title IX at the high school level. Webster (2020), using data from the National Center for Education Statistics and the Civil Rights Data Collection, found that only seven states provided athletic opportunities to female students that were proportional to their enrollment in public schools, demonstrating widespread disparity across the country. An investigative series by the Shirley Povich Center for Sports Journalism and the Howard Center for Investigative Journalism (2022) further revealed that the federal data used to monitor compliance are often incomplete or inaccurate, significantly underestimating the extent to which high school girls are underserved in athletics (Newhouse, 2022). Additionally, a report from the U.S. Department of Education Office for Civil Rights (OCR) documented over 3,600 Title IX-related complaints involving high school athletic programs, citing unequal access to participation, inferior facilities, limited coaching, and a broad array of disparities in benefits (Lhamon, 2015). Collectively, this evidence reinforces the conclusion that despite the legal mandate of Title IX, female high school athletes continue to face persistent and widespread inequities in both opportunity and treatment.

Beyond institutional disparities in access and resources, broader social and psychological factors also play a significant role in shaping girls' experiences in athletics. A national report by the Women's Sports Foundation, *Keeping Girls in the Game* (Zarrett, Veliz, & Sabo, 2020), identifies a range of barriers that contribute to girls' lower levels of participation and higher rates of sport attrition compared to boys. These include financial constraints, lack of access to trained coaches, limited female role models, academic pressures, and negative social experiences such as bullying or body shaming. These challenges are often compounded for girls from marginalized communities, further widening the opportunity gap. This research adds depth to the prevailing narrative by showing that gender inequity in high school athletics is not only a matter of facilities and funding but also one of culture, identity, and inclusion—factors that must be addressed in tandem with policy enforcement to fully realize Title IX's promise.

SHIFTING FOCUS

The discussion thus far underscores a tension that is difficult to ignore. Title IX's standards governing athletic participation have been articulated for decades. Courts have clarified the three-prong framework, and the principles underlying substantial proportionality

and accommodation of interest are well established. Yet the cases and examples discussed above suggest that inequities in high school athletics remain persistent rather than exceptional.

This persistence invites a shift in emphasis. The question may not be whether Title IX's substantive standards are sufficient, but whether the mechanisms used to monitor and enforce those standards are equally robust across educational contexts. At the secondary level, enforcement frequently occurs only after disparities become visible through litigation, media attention, or formal complaints. In many instances, inequities surface reactively rather than through routine oversight.

By contrast, colleges and universities operate within a reporting structure that requires the annual disclosure of participation and financial data disaggregated by gender. That requirement does not ensure compliance, nor has it eliminated disparities at the postsecondary level. It does, however, establish a baseline of publicly accessible information that allows patterns to be observed over time.

The difference between these two contexts is subtle but consequential. When compliance depends largely on complaints and investigations, the ability to identify disparities becomes contingent on access to information. The absence of routine, standardized reporting at the high school level raises the possibility that inequities may be harder to detect and slower to correct, not because the law is unclear, but because the informational infrastructure supporting its enforcement differs.

This shift in focus, from substantive standards to enforcement design, provides a useful framework for examining whether structured transparency mechanisms might strengthen Title IX implementation in the K–12 setting

TRANSPARENCY AS ENFORCEMENT INFRASTRUCTURE

Title IX's substantive standards apply equally to higher education and K–12 institutions. What differs is the infrastructure supporting enforcement. At the collegiate level, the Equity in Athletics Disclosure Act (EADA) requires institutions receiving federal funds to publish annual data on participation and financial allocations disaggregated by gender. That reporting requirement does not determine whether an institution is compliant with Title IX, nor does it guarantee proportionality. It does, however, ensure that participation numbers and expenditure patterns are publicly available in a standardized format.

The significance of this structure becomes clearer when contrasted with the K–12 context. At the secondary level, no comparable federal mandate requires schools to publish sport-specific participation data or detailed expenditure information. Although secondary schools participate in the Civil Rights Data Collection (CRDC), that system differs in important structural respects from EADA reporting. The CRDC is administered biennially rather than annually, collects data at a more aggregated level, and is not designed as a sport-specific financial disclosure regime. While it provides valuable civil rights monitoring information, it does not require routine public disclosure of detailed athletic participation numbers by sport alongside gender-disaggregated expenditure data in a format comparable across districts. As a result, the CRDC functions primarily as a federal compliance data tool rather than as a

continuous, publicly accessible transparency mechanism capable of facilitating localized accountability.

Importantly, existing scholarship on Title IX compliance at the collegiate level makes clear that transparency alone does not eliminate inequity. Studies of postsecondary athletics demonstrate that proportionality gaps persist despite EADA reporting requirements. That reality cautions against overstating the effects of disclosure regimes. Reporting does not, by itself, compel compliance.

Scholarly work on regulatory design underscores this distinction. Transparency policies are widely understood not as ends in themselves, but as mechanisms intended to reduce informational asymmetries between institutions and stakeholders (Fung, Graham, & Weil, 2007). By rendering performance metrics and resource allocation patterns publicly observable, disclosure regimes create the conditions under which accountability claims can be evaluated. At the same time, scholars caution that transparency alone does not guarantee compliance; its effectiveness depends upon complementary institutional processes capable of translating information into corrective action (Fox, 2007; Heald, 2006). In this respect, structured reporting in athletics would not replace Title IX's substantive standards, but could strengthen the infrastructure through which those standards are assessed and enforced.

At the same time, the absence of reporting presents a different problem. Where standardized data are unavailable, disparities in participation opportunities, coaching allocation, facilities, or scheduling are more difficult to identify and evaluate. In practical terms, this shifts the burden of detection onto students and families who may lack access to the information necessary to substantiate inequity claims. In a system that relies heavily on complaints and investigations, informational opacity can delay or suppress enforcement.

Viewed in this light, reporting functions less as a solution to inequity and more as a foundational condition for accountability. Structured disclosure reduces informational asymmetry. It allows stakeholders to observe patterns over time. It enables researchers, advocates, and litigants to assess proportionality and treatment disparities with greater precision. It does not guarantee corrective action, but it makes disparities visible in ways that purely reactive enforcement cannot.

The difference between the collegiate and K–12 contexts is therefore not one of legal obligation, but of monitoring design. Postsecondary institutions operate within a disclosure framework that, however imperfect, renders participation and expenditure data systematically observable. Secondary schools generally do not. If Title IX enforcement depends in part on the ability to measure and compare participation opportunities and resource allocation, then the absence of routine, standardized reporting at the K–12 level represents a structural gap rather than a mere administrative detail.

This argument does not suggest that extending EADA-style reporting to secondary education would eliminate noncompliance. Rather, it contends that meaningful enforcement requires a minimum level of transparency. Without accessible and consistent data, assessing proportionality, evaluating program expansion, or verifying accommodation claims becomes significantly more difficult. In that sense, reporting should be understood as enforcement infrastructure: not sufficient to achieve equity, but necessary to make equity enforceable.

ADEQUATE REPORTING SYSTEMS, TRACKING AND AUDIT COMPLIANCE

If transparency operates as a foundational condition for meaningful Title IX enforcement, the absence of structured reporting at the secondary level becomes more than an administrative gap. It becomes a design question: what form of disclosure would meaningfully enhance accountability without imposing unrealistic burdens on school systems?

Extending the Equity in Athletics Disclosure Act wholesale to every individual high school would likely generate significant administrative strain, particularly in smaller or rural districts with limited personnel and budgetary capacity. Secondary athletics are often administered at the district level rather than by individual schools, and governance structures vary widely across states. A direct replication of the postsecondary reporting model would therefore overlook the institutional differences between colleges and K–12 systems.

A more workable approach would involve a district-level reporting framework modeled on EADA principles but scaled to reflect the realities of K–12 administration. Such a framework could require annual disclosure of: (1) participation numbers by sport and gender; (2) basic categories of athletic expenditures disaggregated by gender; and (3) coaching assignments and compensation structures where applicable. The goal would not be exhaustive financial accounting, but standardized, comparable data sufficient to assess proportionality and treatment disparities.

Importantly, many districts already collect elements of this information for internal budgeting or state reporting purposes. Additionally, schools participate in the Civil Rights Data Collection, which demonstrates that some infrastructure for gender-disaggregated reporting already exists. A district-level model could build upon existing data collection systems rather than create an entirely new administrative apparatus. Standardized reporting templates and state-level aggregation mechanisms could further reduce compliance burdens while enhancing consistency.

Transparency alone does not guarantee corrective action. Accordingly, any reporting regime should be paired with basic verification and oversight mechanisms. These need not involve continuous federal audits, but could include periodic review, random sampling, or integration with existing state athletic association reporting processes. The objective would be to ensure that disclosure functions as meaningful accountability rather than symbolic compliance.

Recognizing variation in district size and capacity, implementation could also be phased or tiered. Larger districts with substantial athletic budgets might be subject to more detailed reporting requirements, while smaller districts could satisfy streamlined disclosure obligations. Such scaling would acknowledge resource disparities without abandoning the principle of transparency.

Ultimately, the purpose of a district-level reporting framework would be to make participation and resource allocation patterns routinely observable rather than episodically contested. By standardizing the informational baseline against which Title IX compliance is assessed, such a model would reduce reliance on complaint-driven detection and strengthen the enforceability of existing legal standards.

COMMERCIAL OPPORTUNITIES AND EQUITY

Equal opportunity in sports today is not just about enabling girls to compete and earn college scholarships, it also means expanding their ability to generate income, particularly through Name, Image, and Likeness (NIL) rights. NIL refers to an athlete's legal ability to profit from their personal brand through endorsements, sponsorships, and other commercial ventures, a right that has only recently been extended to college and even high school athletes in the United States. Prompted by changes in NCAA rules and state laws, this shift has transformed the landscape of amateur and collegiate athletics, allowing student-athletes to engage in business activities and benefit financially from their visibility and influence. NCAA, "Interim Name, Image and Likeness Policy," effective July 1, 2021.

Women are increasingly capitalizing on this opportunity. To date, women's basketball ranks third among all NIL-compensated sports, receiving 12.6% of total NIL compensation, trailing only men's basketball (18.9%) and football (49.6%). Remarkably, six women's sports rank in the top ten for NIL compensation, and women's basketball, volleyball, and softball all earn more NIL income than baseball, the third most profitable men's sport (Balasaygun, 2022). During the 2022 March Madness tournament, four of the top five NIL earners were women (Lever, 2022). With 12% more women using social media than men, companies are increasingly drawn to female athletes who can effectively promote their brands online. In fact, NIL-compensated female athletes engage in 19.6% more social media activity in support of their sponsorship deals than their male counterparts (Balasaygun, 2022).

In this evolving NIL environment, Major League Baseball (MLB) has taken a landmark step in supporting women's professional sports by announcing a strategic investment and partnership with Athletes Unlimited Softball Leagues (AUSL) (Major League Baseball, 2025). This is MLB's first major investment in a women's professional league and reflects a growing commitment to expanding opportunities and visibility for female athletes at all levels. Through this partnership, MLB will provide financial support, marketing resources, and broadcast coverage to help establish a sustainable platform for professional softball (Major League Baseball, 2025). This initiative not only empowers athletes to leverage their NIL rights on a national scale but also affirms MLB's role in advancing the growth and professionalization of women's sports.

These developments do not displace Title IX's core objectives, nor does NIL compensation fall within traditional proportionality analysis. However, they alter the broader context in which athletic participation operates. Recent legal scholarship characterizes the advent of NIL rights as a structural shift in the economic organization of intercollegiate athletics rather than a mere regulatory adjustment (Holden et al., 2022). By recognizing athletes as participants in emerging commercial markets tied to visibility and brand development, NIL reforms have introduced market-based dynamics into what was historically framed as an educational enterprise. While Title IX doctrine was not designed to regulate commercial endorsement markets, the increasing integration of athletic participation and market opportunity raises questions about how early-stage access to competition, facilities, coaching, and exposure may

influence who is positioned to benefit from these newly legitimized economic pathways. Access to collegiate athletics, and by extension NIL markets, is influenced by developmental pathways that begin at the secondary level. Participation opportunities, quality coaching, facilities, competitive scheduling, and exposure during high school years can shape recruitment prospects and postsecondary placement.

When inequities at the secondary level constrain access to these developmental pathways, the effects may extend beyond immediate participation metrics. They may influence which athletes are positioned to compete at the collegiate level and, consequently, who becomes eligible to participate in expanding NIL markets. The significance of transparency and enforceable equity standards at the K–12 level is therefore heightened in an era where athletic participation intersects with commercial opportunity. This argument does not suggest a direct causal relationship between high school reporting practices and NIL earnings. Rather, it underscores that early inequities may carry amplified downstream consequences in an increasingly commercialized athletic environment shaped by market visibility and brand-based valuation.

RECOMMENDATIONS

Ensuring meaningful Title IX compliance in secondary school athletics requires attention not only to substantive legal standards, but to the institutional design of enforcement mechanisms. As discussed above, disparities at the K–12 level often become visible only after litigation, investigative reporting, or formal complaints. A compliance system that relies primarily on reactive enforcement places substantial burdens on students and families while allowing disparities to persist until formally challenged. Strengthening enforcement infrastructure therefore requires structural adjustments that make compliance more routinely observable and verifiable. Such adjustments reflect a broader understanding within regulatory governance scholarship that accountability depends not only on clearly articulated standards, but on institutional mechanisms capable of rendering compliance visible and assessable over time.

First, a standardized reporting framework at the district level would provide a foundational layer of transparency. Rather than replicating the Equity in Athletics Disclosure Act (EADA) wholesale at every individual high school, a district-based model could require annual disclosure of participation numbers by sport and gender, aggregate athletic expenditures disaggregated by gender, and coaching assignments and compensation structures where applicable. Many districts already collect elements of this information for internal budgeting or Civil Rights Data Collection reporting. A standardized format would enhance comparability while minimizing administrative burden. The purpose of such reporting would not be to create punitive exposure, but to establish a consistent informational baseline against which proportionality and accommodation claims can be evaluated.

Second, periodic verification mechanisms could reinforce the integrity of reported data. Independent compliance reviews—conducted on a rotating or risk-based basis—would serve as quality-control safeguards rather than continuous federal oversight. These reviews could be integrated into existing state athletic association reporting structures or coordinated through state

education agencies. The objective would be to ensure that disclosure functions as meaningful accountability rather than symbolic compliance, while recognizing the resource constraints under which many school districts operate.

Third, funding alignment mechanisms may further strengthen accountability. Rather than imposing immediate or sweeping financial penalties, states could condition certain categories of athletic funding or grant eligibility on demonstrable compliance with reporting and proportionality standards. Incentive-based models—such as compliance certifications tied to eligibility for state athletic grants—would encourage proactive equity assessment without destabilizing educational budgets. The aim would be to integrate Title IX compliance into ordinary governance processes rather than treat it solely as a litigation risk.

Finally, improving access to enforcement processes remains essential. Complaint procedures at both the state and federal levels can be lengthy and complex, particularly for families without legal resources. Establishing clearer timelines for investigation and resolution, along with providing guidance and technical assistance to districts seeking compliance, would enhance procedural fairness. In addition, state-supported mediation or ombuds models could allow equity disputes to be addressed more efficiently before escalating to prolonged litigation.

These reforms do not alter Title IX's substantive framework. Nor do they assume that reporting or audits alone will eliminate inequity. Rather, they recognize that transparency and verification are foundational conditions for effective enforcement. By reducing informational asymmetry and embedding equity review within routine administrative processes, such measures would strengthen the enforceability of existing standards without fundamentally restructuring the statutory scheme.

In an era in which athletic participation increasingly intersects with educational access, scholarship pathways, and emerging commercial opportunities, ensuring equitable developmental environments at the secondary level is particularly consequential. A compliance model that emphasizes structured transparency, periodic verification, incentive alignment, and accessible dispute resolution would move Title IX enforcement in K–12 athletics from episodic correction toward sustained institutional accountability.

CONCLUSION

Over the past five decades, Title IX has substantially reshaped the landscape of educational athletics, expanding participation opportunities for women and girls in ways that would have been difficult to imagine prior to 1972. The growth in high school and collegiate participation reflects the power of a clear statutory mandate coupled with sustained advocacy and enforcement. Yet the persistence of participation gaps, resource disparities, and uneven treatment at the secondary level demonstrates that formal equality does not automatically translate into consistent implementation.

This paper has argued that one of the most consequential differences between postsecondary and K–12 Title IX enforcement lies not in the substantive standards themselves, but in the informational structures that support compliance. While colleges and universities operate within a disclosure regime that renders participation and expenditure patterns publicly

observable, secondary schools generally do not. In a system that relies heavily on complaint-driven enforcement, the absence of routine, standardized reporting at the high school level creates an accountability gap. Disparities may exist without being readily measurable, and enforcement may occur episodically rather than systematically.

The contemporary expansion of Name, Image, and Likeness (NIL) rights underscores the significance of this structural gap. Although NIL compensation falls outside the traditional framework of Title IX proportionality analysis, access to collegiate athletics—and to the commercial opportunities that increasingly accompany participation—depends in part on developmental pathways established during secondary education. Where inequities limit access to participation, facilities, coaching, and exposure at the high school level, the downstream effects may extend beyond immediate athletic outcomes.

Extending structured transparency mechanisms to the K–12 context would not alter Title IX’s doctrinal framework, nor would it guarantee compliance. It would, however, strengthen the infrastructure through which compliance is evaluated. By reducing informational asymmetry and embedding equity review within routine administrative processes, standardized reporting and verification mechanisms could enhance accountability without fundamentally restructuring existing law.

Title IX was designed to ensure that educational opportunity is not determined by sex. Ensuring that this promise is meaningfully realized in secondary athletics requires attention not only to legal standards, but to the systems through which those standards are monitored and enforced. In that respect, transparency should be understood not as a policy preference, but as a foundational condition for equity.

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PUBLIC SENTIMENTS AND PERCEIVED AFFORDANCES OF GENERATIVE AI: CASE OF CHATGPT

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ABSTRACT

As one of the first investigations of the public mindset of a Generative AI (GenAI) tool, this study lies at the intersection of two research streams: public opinion on social media and technology affordances research. This research contributes to literature by extracting the sentiments, emotions, and perceived affordances from the public discourse related to ChatGPT expressed on social media. Specifically, a sentiment analysis on a corpus of 600,938 tweets concerning ChatGPT suggested that neutral sentiment and emotion dominated the conversations about ChatGPT, and the negative emotion could be attributed mainly to anxiety. Next, a latent Dirichlet allocation (LDA) analysis revealed fourteen latent topics underlying the public discourse concerning ChatGPT. We performed theory-grounded inference of technology affordances from the latent topics and mapped ten of the topics into five perceived affordances of GenAI, including content generation, application development, financial gains, human work augmentation, and human work substitution. Adopting the hierarchical view of affordances, we further categorized the GenAI affordances into operational affordances, social affordances, and motivational affordances.

Keywords: ChatGPT; Sentiment Analysis; Technology Affordance; Generative AI; Public Opinion

INTRODUCTION

In November 2022, ChatGPT, or Chat Generative Pre-Trained Transformer, became the fastest internet application to reach 100 million users in history. ChatGPT relies on a large language model (LLM), trained through deep learning on a large amount of textual data, to respond to a user's initial prompts and subsequent replies. Within a short period of time, both entrenched technology firms and new startups have entered the arena and introduced similar LLM based chatbots such as Google Gemini and Anthropic Claude. These Artificial Intelligence (AI) driven chatbots symbolize Generative AI (henceforth GenAI) – AI models capable of following human prompts to generate text, images, and audio-visual contents, based on patterns and structures discovered through machine learning on existing data (García-Peñalvo and Vázquez-Ingelmo, 2023). With the unprecedented rate of adoption achieved by ChatGPT and its competitors, there is growing interest in the potential for GenAI to transform many industries and various aspects of everyday life in the coming years. A report by McKinsey predicted that GenAI could add up to \$4.4 trillion annually to the global economy (Chui *et al.*, 2023). According to Pew Research Center, twenty-one percent of U.S. workers have used AI on the job

(Faverio and Kikuchi, 2026). Companies have also started experimenting with the use of GenAI tools at the enterprise level to improve organizational performance (McKinsey, 2025).

The meteoric rise of ChatGPT and the subsequent proliferation of GenAI tools has also entered the collective mind of the public. Social media has become a primary channel for the public to express their opinions, feelings, and concerns on a variety of issues including emerging technologies. Hence, social media provides a rich source of information for researchers to evaluate public sentiments toward specific topics of interest (Broniatowski *et al.*, 2014). Studies in many academic fields have collected and analyzed microblogs posted on the social media platform commonly known as Twitter (rebranded to X in July 2023) (Kwok *et al.*, 2021; Bachura *et al.*, 2022). By text-mining a corpus of tweets contributed by individual users, scholars have analyzed public discourse on technology-related products and services such as Internet of Things, smart phones, and digital currencies (Bian *et al.*, 2016; Kim *et al.*, 2016; Ye and Zhao, 2021). Insights gained in this stream of research help shed light on public sentiments and the potential drivers for the acceptance or rejection of new technologies and other downstream user behaviors (Stieglitz and Linh, 2013; Bachura *et al.*, 2022). Therefore, by analyzing tweets concerning ChatGPT, we aim to answer the research question: *How does the public respond sentimentally to a GenAI application?*

With the advent of a new technology, one natural question in people's mind is "What can we do with it?" The concept of affordance, originally introduced in ecology to describe an animal's perception of a tool's potential to afford useful actions (Gibson, 1979), has been adopted and expanded by scholars in technology-related fields (Leidner *et al.*, 2018; Zhao *et al.*, 2021). The affordance lens focuses on how technology enables people to perform specific actions and achieve specific outcomes as part of users' goal-oriented behavior. It is less concerned with psychological characteristics and cognitive processes (Gaver, 1991). Applying the theoretical perspective of technology affordance, we also address the question: *What are the perceived technology affordances of a GenAI application, as revealed in the public discourse?* Furthermore, instead of treating affordances of a technology tool as a collection of independent constructs, several authors have recently proposed the hierarchical view of the interrelations among technology affordances (Leidner *et al.*, 2018; Zhao *et al.*, 2021). Therefore, to achieve a high-level overview of the structure of the collection of GenAI affordances, we also applied the hierarchical view and discovered a three-level hierarchy that can serve as a framework for future investigation of GenAI affordances.

RELATED WORK AND RESEARCH BACKGROUND

GenAI and ChatGPT

Implementations of GenAI tools started to emerge in the late 2010s and vary in the type of underlying AI model, content generated, and application domains (García-Peñalvo and Vázquez-Ingelmo, 2023). The rapid advancements of supporting technologies such as neural networks and deep learning allow GenAI tools to achieve unprecedented output quality and gain broad recognition by the public in the 2020s.

Powered by OpenAI's generative pre-trained transformer (GPT) large language model, ChatGPT was initially trained using a combination of supervised and reinforcement learning techniques to perform human-like conversations in natural languages. OpenAI has also integrated ChatGPT with other products such as the DALL-E image generation AI to expand its

capabilities. Since its launch, reported use cases of ChatGPT have ranged from writing Python code to drafting syllabi for college classes, often with output quality on par or exceeding human work. In an idea generation task for new consumer products, ChatGPT 4.0 outperformed MBA students at the Warton School in speed, cost, and quality of ideas generated (Girotra *et al.*, 2023). However, the real-life use of ChatGPT sometimes leads to controversies among the stakeholders in the application domain. For example, the listing of ChatGPT as co-author of research papers by some scholars has generated debates in the academic research community on acceptable conducts concerning the use of the GenAI tool (Stokel-Walker, 2023). In addition, many have observed the tendency for GenAI models to hallucinate, i.e., generating responses with inaccurate or nonfactual information (Ji *et al.*, 2023).

Despite the potential shortfalls, the positive impact of GenAI tools such as ChatGPT is well-recognized (Chui *et al.*, 2023; Vogels, 2023; The Conference Board, 2023). Anecdotally, GenAI applications are widely regarded as personal productivity enhancing tools (Leonard, 2026). Empirical evidence has also emerged supporting the impact of GenAI tools, especially GPT-powered chatbots, on productivity of information workers. In an online experiment with 453 college-educated professionals performing a writing task, those assisted by GPT-3.5 significantly outperformed the control group in productivity and output quality (Noy and Zhang, 2023). The use of the GenAI tool also reduced the inequality in productivity among participants (Noy and Zhang, 2023). In an experimental study, consultants completed various creative and analytical tasks for a simulated client. Consultants using ChatGPT 4.0 in completing their tasks are more productive, more efficient, and generate significantly higher quality work than those in the control group (Dell'Acqua *et al.*, 2026). In addition, the productivity and quality enhancement achieved with ChatGPT is more prominent for less skilled consultants.

Given the status of ChatGPT as the GenAI tool with the highest level of public awareness and usage at the time of this study, we chose ChatGPT as the focus of our research on public sentiments and opinion of GenAI.

Text Mining of Social Media Contents

Researchers have applied text mining techniques on collections of user-generated social media contents to uncover valuable patterns reflecting public opinion (Broniatowski *et al.*, 2014). Heightened user activities triggered by events ranging from disease outbreaks and high-profile product announcements to information security breaches and presidential elections often provide fertile grounds for researchers to analyze the public discourse on specific issues in different realms of intellectual inquiry (Kwok *et al.*, 2021; Ye and Zhao, 2021; Bachura *et al.*, 2022; Chen and Ye, 2025). On any given issue, a study in this broad stream of opinion mining research typically achieves one or both interrelated goals: first, assessing the public sentiments and emotions toward a certain event or entity, and second, gaining further insights by revealing the underlying topics and themes in the public discourse concerning the event or entity.

To achieve the first goal, researchers quantitatively assess user emotions expressed in social media contents by means of sentiment analysis. For example, Stieglitz *et al.* (2018) analyzed the discourse on Twitter surrounding Volkswagen's Dieselgate scandal and found that tweets with negative sentiment far outnumbered the positive tweets. In a study on conversations concerning the malaria disease on Twitter, Boit and El-Gayer found that 35 percent of the tweets were negative while 25 percent were positive. They also observed that the dominating emotions expressed in the malaria-related tweets include sadness, disgust, joy, and anger. Following a

widely publicized hacking incident and breach of personal data, anxiety, anger, and sadness were the most prevalent emotions on Twitter (Bachura *et al.*, 2022). These results help investigators evaluate the public attitudes toward respective issues. Studies also suggest that emotions and sentiments potentially predict user behavior such as information sharing and engagement. For example, tweets with stronger overall sentiment are more quickly and more frequently retweeted (Stieglitz and Linh, 2013). At different stages of public awareness in the aftermath of a public data breach, the dominant emotions expressed in tweets also bring higher levels of retweets (Bachura *et al.*, 2022).

Regarding the second goal, a growing body of research has extracted the latent topics and themes contained in the public discourse on specific issues on social media, especially Twitter. While some authors relied on manual content analysis on small data sets to classify tweets into categories (Brunner *et al.*, 2019), in recent literature latent Dirichlet allocation (LDA) has emerged as a commonly used computational technique to perform topical analysis on large quantities of user posts (Kwok *et al.*, 2021). As an unsupervised machine learning method, LDA extracts underlying topics from a collection of textual documents by uncovering clusters of words that have high probability to appear together. In a study seeking to understand public opinion on COVID-19 vaccination, for instance, Kwok *et al.* (2021) applied LDA to uncover common topics from the discussion on COVID-19 vaccines among Australian Twitter users.

Scholars have also examined sentiments and topics in social media discussions concerning technology products and services. For example, Bian *et al.* (2016) found that sentiment toward the Internet of Things expressed on Twitter was leaning positive. LDA analysis also revealed abstract topics including smart technologies, connected device, and big data among the tweets on Internet of Things. Similarly, Ye and Zhao (2021) analyzed twitter conversions on Facebook's Libra digital currency initiative immediately after the official announcement. Sentiment analysis suggested that while positive attitudes outnumbered negative attitudes, the public was predominately neutral toward the proposed digital currency. Anger and anxiety were the main contributing emotions to the negative sentiments. Topical modeling analysis using LDA revealed latent topics such as blockchain, banks, regulation, trust, and people in the public discourse related to the Libra digital currency.

The rapid rise of GenAI tools has also stimulated intensive discussions recently regarding the potential roles of GenAI in different areas of academic research (Epstein *et al.*, 2023; Salah *et al.*, 2023). However, research has yet to address public sentiments and perceptions toward GenAI, a technology that is anticipated to have profound impacts on how people access and create information in their everyday lives (Hirvonen *et al.*, 2023). In this study, we utilized commonly used social media analytics techniques to assess the opinion expressed in the public discourse related to ChatGPT, currently the most widely known and used GenAI tool.

Technology Affordance Theory

The notion of affordance, originally introduced by ecological psychologist James Gibson (1979), has been adapted to interpret how technological objects enable users to achieve specific and tangible goals through human-technology interactions (Gaver, 1991). A technology affordance describes the potential for actions offered to a user by an information technology artifact (Leidner *et al.*, 2018). Alternatively stated, an affordance is a property of the relationship between a user and the technology, linking the capabilities afforded by the technology to the user's purposes (Faraj and Azad, 2012). Gaver argues that "affordances are the fundamental

objects of perception” (1991, p. 79), because people’s perception of their surrounding environment immediately reflects what they see as the potential for action. For instance, a person views a computer keyboard as a tool providing typeability: a perceived affordance of typing to input information into a computer system. The forming of this perception would not require a cognitive process involving memory or inferences (Gaver, 1991).

Identification of the distinctive affordances of specific information technologies is a common element of technology affordance research. The following example illustrates the identification and conceptualization of affordances in a typical technology affordance related study. Leidner et al. (2018) analyzed the use of an enterprise social media tool named OnBoard by newly hired IT workers in a financial service firm. From the users’ firsthand accounts of their interactions with OnBoard, they first extracted uses of the social media tool such as *connect to others* and *post status updates*. Based on these uses the researchers summarized *interacting with peers* as one of the affordances of OnBoard to the users. As another example, uses such as *list and search for housing, roommates, carpools, and ride sharing arrangements* are reflected in the affordance of *finding resources*. Furthermore, the authors argue that finding resources represents a second-order affordance that depends on the first-order affordance of interacting with peers. In other words, the affordance of interacting with peers needs to be actualized (put into actions by the users) before the affordance of finding resources can be actualized.

Research on emerging technologies has also used a similar process of inferring affordances from concepts extracted directly from underlying data. In an investigation of the affordances of blockchain technology used in the procurement division of a large conglomerate, Du et al. (2019) first discovered concepts such as *potential to remove manual verification*, *potential to remove manual reconciliation*, and *potential to build automatic triggers* from interview logs and archival data. The affordance of *potential to automate transactions* derived from these three conceptual uses. Following a similar process, Osmundsen et al. (2022) examined the use of digital twin technology in a Norwegian power grid company, through manual topical analysis of qualitative data including interviews, observations, and archival data. The authors identified perceived affordances such as *automatability*, *operatability*, and *decision supportability*, each representing a user-perceived potential for action with the digital twin.

According to Gaver (1991), affordances epitomize the ecological approach of examining human-computer interaction of emerging technologies. The ecological perspective “stresses relevant human-scaled objects, attributes and events and the patterns of energy that provide effective perceptual information about them” and offers “a more succinct approach to the design of artifacts that suggest relevant and desirable actions in an immediate way” (Gaver, 1991, p. 79). Compared to the cognitive approach, the ecological approach encourages researchers to be less concerned about the mental process occurring “in the head” of technology users, and rather focus on the everyday actions that potentially transpire “in the world”, thus achieving a better balance between the socio and the technical aspects of sociotechnical research on technologies (Gaver, 1991). These advantages of the affordance approach are particularly salient considering the nature of GenAI as a nascent technology in an early stage of public adoption (Hirvonen et al., 2023) and are well-aligned with our interest of exploring the public perception of the novel technology through topical analysis of the public discourse concerning ChatGPT. Therefore, we apply the affordance perspective in this study, and we expect perceived affordances of GenAI to emerge in the topics extracted from the social media data.

RESEARCH METHODS

Data Collection

We collected tweets using ChatGPT and its variants and related hashtags as search terms. Data collection started on February 1, 2023 and lasted until July 11, 2023, when the platform no longer provides free data access for researchers after the rebranding. We developed a custom program in R using the rtweet package to perform the data collection through Twitter's developer API. Using the data filtering features provided by rtweet, we included only English language tweets and excluded retweets. The custom program also performed the preprocessing and cleaning steps such as removing links, user mentions, and typographical symbols and punctuation marks.

Data Analysis

For sentiment analysis, we used LIWC-22, a widely used research tool for analyzing the emotional, cognitive, and structural constructs in text written in natural languages (Boyd *et al.*, 2022). LIWC-22 measures variables encompassing categories such as affect, cognition, and perception in psychological processes. To measure each variable for a text sample, LIWC calculates the percentage of words that match a variable-specific dictionary out of the total number of words. For example, given the four-word sentence "I love video games", "love" is the only word included in the dictionary for positive emotion, hence yielding a score of 25% for the positive emotion variable.

Among the many measures reported by LIWC-22, variables pertinent to the present study include tone (reflecting sentiment in general) and emotion. Negative tone, positive tone, negative emotion, and positive emotion are categorized as variables under affective dimensions. In addition, anxiety, anger, and sadness are the variables capturing subdimensions of negative emotion. Based on recent research on language and culture, LIWC-22 incorporates various improvements, including the separation of emotion as a "pure" representation of people's emotional response different from general sentiment (Boyd *et al.*, 2022). While the new dictionaries for emotion contain words such as "love", "angry", and "scary", dictionaries for tone contain additional words such as "beautiful", "holiday", and "kill" (Boyd *et al.*, 2022).

Consistent with prior research, we multiple the measure of each variable generated by LIWC-22 by 100 to reach a continuous score. We then measure the direction and strength of the overall sentiment or emotion of each tweet by calculating the polarity:

$$polarity(tone | emotion) = positive(tone | emotion) + negative(tone | emotion)$$

where positive denoted the positive tone or emotion scored from 0 to 100 and negative denoted the negative tone or emotion scored from -100 to 0. The polarity score falls within the range [-100, 100], and 0 represents neutral sentiment or emotion.

We used LDA, an algorithm for probabilistic topic modeling, to conduct the topical analysis of the public discourse concerning ChatGPT. LDA is a widely used tool "for discovering the main themes that pervade a large and otherwise unstructured collection of documents" (Blei, 2012). Using LDA, Blei (2012) mined the corpus of 17,000 publications from

the journal Science and uncovered topics such as “Genetics”, “Evolution”, “Disease”, and “Computers” from the articles. Each topic consists of a list of words ranked by their probabilities of appearing in articles discussing the assigned topic. For example, “human” is the topical word most likely to appear in Genetics related articles, followed by “genome”, “dna”, “genetic”, and “gene”.

Lastly, we closely examined the topical words and samples of associated tweets of each topic and performed theory-grounded inference of technology affordances of GenAI. Recognizing what Norman (2015, p. 235) refers to as “ontological chaos” concerning the meaning of the term “affordance”, we adhere to the generally agreed view by IS scholars that a technology affordance is a goal-oriented action or potential for action afforded by a technology to the users that transcend mere use of technology features (see Leidner et al. (2018) for an in-depth discussion of the concept of technology affordance and its distinction from technology use and outcome). Following a similar process of technology affordance identification in prior studies (Leidner *et al.*, 2018; Du *et al.*, 2019; Osmundsen *et al.*, 2022), we group first-order concepts revealed in the topical analysis and summarize them into GenAI affordances, guided by the definition of technology affordance.

RESULTS

After eliminating duplicate tweets and retweets, the corpus includes 600,938 original tweets contributed by 296,076 unique users.

Public Sentiment and Emotion

In terms of sentiment polarity, 32.2% of all the tweets showed a positive tone, 8.8% were negative, and 59.1% were neutral. For the more narrowly defined emotion construct in LIWC-22, 8.0% tweets were positive, 3.8% were negative, and 88.2% were neutral. Furthermore, paired-samples t-tests were conducted to confirm that the sentiment and emotion of tweets were significantly more positive (for tone, $t = 257.99$, $p = 0.00$; for emotion, $t = 82.09$, $p = 0.00$).

The treatment of sentiment and emotion as separate constructs in LIWC-22 leads to nine possible combinations of positive, neutral, and negative sentiments and emotions for each tweet associated with ChatGPT. To provide a closer look at tweets featuring different sentiment-emotion combinations, samples are shown in Table 1. Each tweet is shown in the original form with @ user mentions and links removed.

Table 1 Sample Tweets with Different Sentiments and Emotions		
Sentiment	Emotion	Sample Tweets
Positive	Positive	chat gpt is awesome! I love learning and asking questions!
Positive	Neutral	Well, #chatGPT to the rescue. It's my new favorite co-worker:
Positive	Negative	just had a great short convo with chat gpt and it's scary how smart it is.
Neutral	Positive	Me and a client are in a #ChatGPT negotiation - this is fantastic. The robots are battling!
Neutral	Neutral	Waiting for chat gpt to stop being at capacity so I can do some work and write some emails
Neutral	Negative	Chat GPT (and AI in general) is really cool but even more so terrifying
Negative	Positive	Chat GPT is a bit dodgy, excellent for lecturers but not good for students
Negative	Neutral	ChatGPT not killing creative minds. It's just making dumb minds, dumber!
Negative	Negative	This is horrifying. We aren't even close to understanding the dangers of #chatgpt

Statistical analysis on negative emotions indicated that the average scores for anxiety were significantly higher than those for anger ($SD = 1.32$, $t(600937) = 31.39$, $p = 0.00$) and sadness ($SD = 1.18$, $t(600937) = 57.24$, $p = 0.00$), and the scores for anger were higher than sadness ($SD = 0.98$, $t(600937) = 26.98$, $p = 0.00$).

Topics of the Public Discourse and Perceived Affordances of Generative AI

Our second research question concerns the perceived affordances of a GenAI application. We followed a two-stage process like prior technology affordance studies to identify the perceived affordances from the qualitative data collected from the users (Du *et al.*, 2019, Osmundsen *et al.*, 2022). First, a topical analysis aims to uncover the prevalent topics from user discussions of ChatGPT. Second, we examine the topics emerged and underlying tweets to discover actions rendered possible by ChatGPT for users to achieve a purpose, i.e., affordances.

To uncover abstract topics, we performed text mining on the pre-processed dataset using LDA, following an iterative process of adjusting parameters of the algorithm (Bian *et al.*, 2016). Due to the unsupervised nature of LDA and the large size of the corpus, human intervention is necessary in identifying meaningful topics (Bian *et al.*, 2016). We excluded the list of stop words supplied with the machine learning from language toolkit (MALLET) (available at mallet.cs.umass.edu), and added several words — “AI”, “chatgpt”, “chat”, and “gpt” — to avoid these words preventing the true latent topics from emerging.

Fourteen topics (Table 2) emerged in the topic modeling analysis. Close examination of the topical words and associated tweets suggests that ten of these topics address the broad question of “what can ChatGPT do for us and what can we accomplish by using ChatGPT?” In other words, discussions of the affordances of GenAI dominated the public discourse on ChatGPT. From the topics identified in the corpus, we further inferred five affordances of GenAI, as listed in Table 2.

Table 2 Topics and Perceived Affordances of GenAI		
Topics	Topical words	Perceived Technology Affordances of GenAI
<i>Topics related to affordances</i>		
Answering questions	answer question give response asked understand wrong	Content generation – potential to generate digital contents
Generating textual content	content create prompt writing text generate ideas image	
Generating visual content	midjourney art create generative images aiart dalle	
Application development	code app api powerful tool build website plugin latest python	Application development – potential to develop third party applications
Making money in general	make money life people work start online	Financial gains – potential to achieve monetary benefits
Stock trading	trading stocks buy options market free based min short	
Cryptocurrency trading	crypto nft bitcoin blockchain btc web project	
Business uses	business marketing experience digital seo improve productivity design	Human work augmentation – potential to augment work produced by human information workers
Educational uses	students education school writing tool learning research	
Employment impact	human job people replace work	Human work substitution – potential to replace the need for human information workers
<i>Topics unrelated to affordances</i>		
Model training	language model text large llm train human open	
Within tech industry	google bing bard search microsoft powered chatbot openai engine rival	
Privacy and security	data privacy cybersecurity security italy concerns ban	
General discussion	tool generative chatbots assistant technology	

Next, we briefly discuss these affordances and topics with sample tweets. Each sample tweet is presented in the original form with minor changes (e.g., removal of user mentions) for readability.

Content generation

GenAI tools such as ChatGPT afford users the ability to generate valuable digital artefacts by feeding the tools with expertly constructed prompts. In combination with other GenAI tools such as Midjourney, the capabilities of ChatGPT have expanded from the generation of text to a variety of content including images, sound, and video. Three topics revolve around these immediate capabilities of ChatGPT. One of the most well-known uses of

ChatGPT is to answer questions. Many users shared their experience with the question-answering capability of ChatGPT: *“Disappointed with ChatGPT’s response on JavaScript. Asked a JavaScript question, but the answer was incorrect.”* Some users also offered their advice: *“Want to make the most of ChatGPT? Start by asking specific questions that can be answered with a clear response.”* In addition, ChatGPT’s ability to generate textual contents following prompts is often discussed: *“Chat GPT is an amazing tool that will help you create content like a pro. Here are some of our fav ChatGPT prompts.”* The same goes with visual content generation: *“Generating long midjourney prompts with ChatGPT to create stunning AI Artwork! Check out the tips and tricks.”*

Application development

Through an Application Programming Interface (API), ChatGPT also provides developers with a platform to design and implement third-party applications that utilize the underlying capabilities of the GenAI tool. Therefore, creating innovative products and services powered by GenAI is another affordance of tools such as ChatGPT. Development related issues attracted some user discussions: *“Created a MATLAB app called MatGPT, that calls ChatGPT API, and runs MATLAB code it generates. Here is an example.”*

Financial gains

Some users seek information on monetizing their skills and experience with the GenAI tool. Others use the GenAI tool as a free robo-advisor and attempt to solicit investment advice such as lists of stocks or cryptocurrencies. These needs to derive direct monetary benefits from ChatGPT reflect an affordance of achieving financial gains. The prospect of making immediate monetary gains from ChatGPT was the focus of three specific latent topics. Some discussions address the possibility of making money in general: *“People who claim to make money on ChatGPT usually don’t. Those who actually have an income through it stay quiet.”* Other posters are interested in using ChatGPT as a tool in their trading of stocks or cryptocurrencies: *“I asked ChatGPT to use finviz to find stocks & OptionsTrading strategies with strong fundamentals, positive growth prospects & history of stable price movements. Using fundamental analysis & assess factors such as earnings, revenue, competitive position & industry trends”* and *“ChatGPT Was Asked to Make a Bitcoin Price Prediction: This Was the Result”*.

Human work augmentation

Used properly, GenAI tools help information workers ranging from marketing executives to college students to augment their work in their respective roles. However, over-reliance on GenAI tools also raises concerns over negative impacts on human productivity. Many have commented on the augmenting role of ChatGPT when applied in the work routine of different business fields such as marketing: *“Just used ChatGPT to create a marketing plan for one of my businesses and it’s blown me away.”* Concerning the effect of ChatGPT on education and student learning, one sample tweet states: *“ChatGPT banned by many schools and colleges abroad citing threat to education sector which is making students lazy.”*

Human work substitution

In contrast to augmenting human work (e.g., creating a first draft of a marketing plan for a manager), from the perspective of employers, GenAI also brings the possibility of replacing certain job functions of human workers with automation (e.g., eliminating the need for human photographers by completely relying on AI-generated digital photos for advertisements). Users have various opinions on the potential impact on human employment: *“AI will not replace your job, but a human using AI will replace your job - if you are not using AI.”*

Four additional topics reflect concerns or implications of ChatGPT that are unrelated to affordances. One topic addresses the training of the LLM, e.g., *“The new wave of Instruction based tuning (and training) for Large Language Models (LLM) like ChatGPT has started.”* Another cluster of conversations focuses on the privacy and security of personal data: *“Italy's temporary ban on ChatGPT sparks privacy and data security concerns in other EU countries.”* In the context of the competitive landscape within the technology industry, a user commented: *“When ChatGPT squashes competition, Microsoft's Bing is all smiles, but Google's Bard finds a grave situation!”*

The public discourse also encompasses other issues that arise with the use of ChatGPT. These issues did not emerge as separate topics in the text mining analysis due to the relatively small number of tweets devoted to each issue. Instead, we discovered an umbrella topic for general discussion with words such as “tool” and “generative” as the main commonality. Examples of general discussion tweets include *“The rise of generative AI tools like ChatGPT make creating fake news, viral hoaxes, and phishing scams trivial”* and *“ChatGPT and other generative AI tools may not be shielded by Section 230 from liability for user-generated content.”*

DISCUSSION

This paper presents an exploratory assessment of public sentiments and perceptions toward a GenAI tool. We collected and examined micro-blogs related to OpenAI's ChatGPT posted on Twitter during a five-month period. The results indicate that a high-profile GenAI tool received strong interest from a large user base on a social media platform. More than a quarter million Twitter users contributed to the public discourse on ChatGPT. To our knowledge this is one of the first studies that took a data-driven approach to understand how the public views GenAI.

Public Sentiments Toward ChatGPT

To answer the first research question, we analyzed the direction and strength of sentiments and emotions expressed by tweets using LIWC, an empirically validated text analytics tool for sentiment analysis. The results indicate that neutral sentiment dominated the conversations about ChatGPT, and an overwhelming majority of tweets are non-emotional. This finding is significant because it suggests that most of the general public is still not predisposed to like or detest a GenAI tool. Recent survey studies on public sentiment toward AI have demonstrated a mixture of positive opinions about the potential of the technology and concern about possible negative outcomes (Kelley *et al.*, 2021). Public sentiment is driven more by curiosity of the opportunities for future development of AI and less by negative emotions such as anger and disgust (Čater *et al.*, 2023). Using a large-scale social media dataset, our finding confirmed that the public largely remain neutral and open to the debate, and their views are more likely to be determined by reason than emotion.

Excluding the neutral tweets, a significantly higher level of positive sentiments and emotions is exhibited in the public discourse, suggesting that the more sentimental portion of the population have an optimistic outlook of GenAI. A further exploration found that the negative emotion in the corpus could be attributed mainly to anxiety rather than anger and sadness,

suggesting that the public is primarily concerned with the uncertainties and risks in the early stage of assimilating GenAI into the ways people live, work, and play.

Perceived Affordances of GenAI

Addressing the second research question, we first performed a topical analysis employing a commonly used unsupervised machine learning algorithm. Methodologically, the algorithmic topical analysis was conducted without any preconception regarding the topics and themes underlying the public discourse related to ChatGPT. In other words, unlike prior technology affordance studies, we did not specifically seek affordance-related topics at the topical analysis stage. Nonetheless, ten of the fourteen latent topics discovered are mapped conceptually to technology affordances. As a contribution to the technology affordance and technology innovation literature, the result of this study presented strong empirical evidence supporting the notion that technology affordances are the preeminent consideration for potential adopters of a novel technology such as GenAI (Hirvonen *et al.*, 2023).

To the best of our knowledge, this study is among the first that lies at the intersection of two research streams: public opinion on social media and information technology affordances. This study shows that the technology affordance approach provides a valid theoretical perspective for analyzing and interpreting the findings of public opinion mining studies. Prior studies typically relied on datasets with limited scope such as a single organization to gain insights into the affordances of a specific technology. Some authors have argued conceptually for utilizing user generated online content as a source for identifying affordances because of the real-world context, high volume, and ready availability of the data (Shu *et al.*, 2015). However, the sheer volume of online user generated content challenges the feasibility of performing any manual analyses to arrive at a set of first-order topics or concepts necessary for further inference of technology affordances. This study bridges this gap and demonstrates that algorithmic topical analysis can aid researchers in identifying perceived affordances of an emerging technology in an early stage of public adoption. For future technology affordance research, especially when it concerns internet-based technology aiming for a broad userbase, the value of social media as a rich and easily accessible source of data should not be overlooked.

Our findings also align with the latest advancements in nuanced understandings of technology affordances. The existence of negative affordances, e.g., a knife affording the potential to cut a person, has been discussed by authors in other fields. From the employees' point of view, human work substitution is apparently a negative affordance of GenAI. We did not map the topic of privacy and security to an affordance because most of the discussions on this topic in the dataset do not entail goal-oriented actions enabled by GenAI. However, it is highly conceivable that a negative affordance will emerge in the future with increasing public awareness of the use of GenAI by unscrupulous actors to harm the privacy, security, and other interests of their victims. Our result lends further support to recent work that acknowledges the possibility for technology tools to afford actions leading to unfavorable outcomes (Chen, 2019; Hirvonen *et al.*, 2023).

Experts in design science research have recognized the importance of technology affordances and called for more investigations of the affordances of AI (Norman, 2015). However, only a small number of studies have addressed AI affordances so far (Hirvonen *et al.*, 2023), and most focused on specific AI application domains such as learning (Jeon, 2021; Zhang *et al.*, 2023; Kakhki *et al.*, 2024). This study answers to the call for researchers to be more

attentive to the affordance of AI systems in everyday information seeking (Hirvonen *et al.*, 2023) and contributes to the broad research of sociotechnical aspects of AI by identifying an inventory of affordances that are generalizable to different application domains of GenAI. In addition, our findings are consistent with several anecdotes regarding public perceptions of GenAI. For example, according to Gallup, seventy-two percent of top human resource executives in Fortune 500 companies expect AI to replace human workers in their organizations within three years (Barrett and Pendell, 2023). Naturally, human work replacement is a prominent negative affordance of GenAI from the perspective of the employees. For instance, during the Hollywood actor and writer strikes of 2023, regulation of GenAI usage became one of the most contentious issues among the parties involved (Collier, 2023). Most recently, the potential for GenAI to reduce demand for human workers, especially information workers, has been recognized as the driving force for prominent companies to lay off thousands of employees (Davenport and Srinivasan, 2026). Researchers at Tufts University also estimated that 9.3 million U.S. jobs, mainly high-paying knowledge worker jobs, are at the risk of being displaced by AI in the next two to five years (Digital Planet, 2026). Our results leave no doubt that impact on human employment is a crucial component of the collective mindset of the public toward GenAI.

Somewhat surprisingly, the possibility of achieving monetary gains afforded by GenAI emerged prominently as an affordance with three underlying topics. The ability to make money from a novel technology is arguably one aspect of the all-important perceived usefulness concept in technology adoption literature. Despite the popularity of “make money online” in common parlance, it is an aspect that has not garnered much attention in prior research on technology adoption. This omission could be the result of the overwhelming attention given to how employees accept work-related technologies in existent literature. However, GenAI tools such as ChatGPT and Midjourney are openly available to the entire population with little restrictions on the purpose of individual use. This finding points to the need to consider the innate human desire to profit from using a tool in future research on adoption and usage of GenAI applications. It also adds to the growing evidence for scholars to treat technologies widely accessible for personal and everyday use differently from workplace information systems (Ye and Potter, 2011; Hirvonen *et al.*, 2023).

Hierarchy of GenAI Affordances

To further interpret the findings of this study, we examined the interrelationships among the GenAI affordances discovered. We found the hierarchical view of affordances to be an appropriate lens for understanding the structure of multiple affordances of a technological tool. Researchers have pointed to the potential hierarchy among affordances of a given technology (Leidner *et al.*, 2018). Zhao *et al.* (2021) fully developed this argument by proposing a hierarchy of affordances of information tools consisting of three levels. At the bottom level of the framework, handling affordances are related to “the physical aspects of tools and the manifest conditions that influence operations” (p. 235). In line with Gibson’s original conceptualization of tool affordance to animals, a handling affordance is realized through a tool user’s interactions with the physical environment. The handling affordances address the “how-to” issue of tool usage, and it does not involve social interactions. For example, the possibility of writing words on a compatible surface is the main handling affordance of a pen.

At the middle layer, effector affordances describe a user’s potential accomplishments through interactions with a tool and related mediating social artifacts such as language, norms

and regulations within a sociocultural environment (Zhao et al., 2021). The effector affordances capture “what” aspect of tool usage - the possibilities for social actors to achieve meaningful goals with the tool. For a pen, writing a letter to another person would be an effector affordance.

At the top of the framework, motivational affordances refer to “the possibilities for satisfying the motive of the individual or the collective” (Zhao et al., 2021, p. 236). Motivational affordances reflect fundamental human needs that are more macro and abstract than the lower-level affordances (Zhao et al., 2021). For example, communicating one’s thoughts and ideas and spreading intellectual knowledge could be the ultimate motivation for a person to use a pen as a writing tool. Clearly, motivational affordances address the question of “why” a tool is being used.

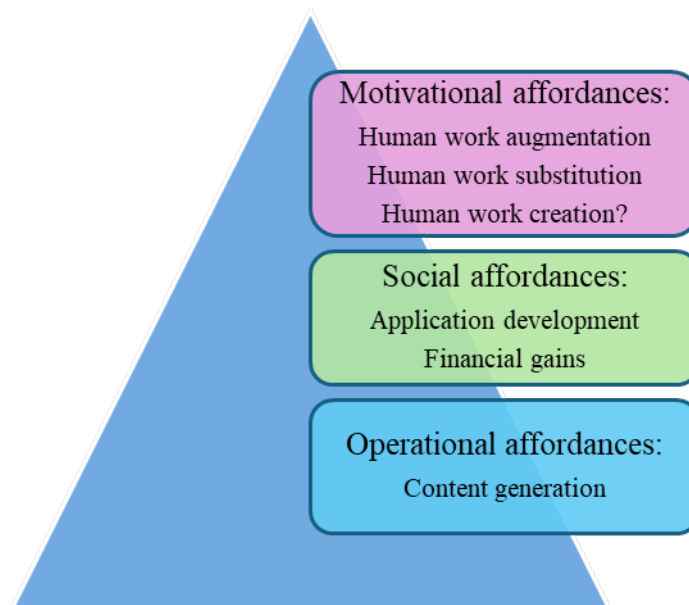
Adapting the three-level framework developed by Zhao et al. (2021), our examination led to the classification of the GenAI affordances into the following three layers: operational affordances, social affordances, and motivational affordances, as shown in Figure 1. At the bottom layer, content generation falls under operational affordances, because it only involves the direct interactions between the user and the tool. The realization of content generation is the enabling factor for all higher-level affordances; therefore, this affordance serves as the foundation of the hierarchy.

Financial gains and application development reside in the middle layer of the hierarchy as social affordances, the equivalent of effector affordances in Zhao et al. (2021), because they both implicitly and explicitly depend on social interactions. Developing application on top of the ChatGPT platform is a highly social endeavor. Human-to-human interactions permeate the application development process, including collaborating with team members, soliciting user requirements, obtaining advice and technical assistance from the API provider and the developer community, seeking feedback for pre-release versions, advertising the completed program, providing user support after release, and so on. Making money also requires social interactions, often in the form of financial transactions between two individuals, mediated by social constructs such as stock and cryptocurrency exchanges, advertisement venues, payment systems, and banking facilities.

At the top of the hierarchy, motivational affordances answer the question of why people might be interested in using GenAI. Fundamentally, GenAI affords the opportunity to either augment human work or substitute products of human labor with work produced by generative technologies. In our dataset, we also observed discussions of new forms of human work such as AI prompt engineering that are created with the arrival of GenAI. Although it did not emerge as a unique topic in our analysis, with the intention of stimulating future research, we included human work creation as a potential motivational affordance in the framework.

To our knowledge, this study is among the first that present empirical evidence supporting the hierarchical view of affordances by demonstrating the existence of affordances of a given technology at each level of the conceptual framework proposed in prior research (Zhao *et al.*, 2021).

Figure 1
Hierarchy of Generative AI Affordances



Limitations and Recommendations for Future Research

Limitations of the present study also led to our recommendations for future research. We studied public discourse concerning ChatGPT at the beginning of GenAI adoption. With the advances in the underlying technologies, the expanding landscape of GenAI applications, and the arrival of agentic AI, we expect salient affordances to emerge at each level in the future. To date, the results of the present study demonstrated robustness in the context of the subsequent developments. For example, the use of GenAI to either augment or replace human work has been actualized to a substantial degree, and the threat posed by GenAI on human employment occupies the center stage of the public discourse (Digital Planet, 2026). Nevertheless, we are still in the early stage of the adoption and assimilation of GenAI into different aspects of people's lives. Over the years, as social media evolved and expanded, a stream of research also evolved in the literature to address the affordances of social media, with each study furthering the understanding of social media affordances (e.g., Leidner, 2018). Given the rapidly increasing importance of GenAI, we contend that research on the affordances of GenAI also deserves the same kind of continuous endeavor. To further our understanding of the affordances of GenAI, we encourage researchers to apply multiple methods and utilize data from multiple sources such as user surveys, observations, review and aggregation of existing academic and practical literature, and social media analytics. For scholars interested in replicating our approach, the API access pricing model implemented at X after summer 2023 has made large scale data collection like the present study costly. We suggest researchers without the needed fundings to explore other social media platforms such as Reddit and Facebook for similar studies. We have found that other social media platforms yield much smaller datasets compared to X. A more longitudinal approach may help in achieving a corpus of desirable size.

At the time of data collection for the present study, ChatGPT was the prevalent GenAI application available to the public. There has been an explosion of competing GenAI applications in recent years. Moreover, LLM-driven generative AI features have been integrated into a variety of software applications. It is our recommendation that multiple representative GenAI tools be investigated in future studies on GenAI affordances. In addition to general purpose chatbots, researchers should also explore the unique affordances of GenAI related technologies designed for specific application domains (Wu and Chiu, 2025; Zhang, 2026).

During our data collection, ChatGPT was primarily a tool used by individuals in non-organizational settings. Subsequently, GenAI tool developers have launched many enterprise GenAI offerings and GenAI features have permeated productivity software tools designed for organizational usage. Many organizations have started using GenAI for individual business functions and experimenting with AI tools at the enterprise level (McKinsey, 2025). Therefore, we encourage examinations of affordances of GenAI incorporated in organizational technologies in future research.

Our dataset is also limited to tweets written in English and it does not include the universe of public discussions concerning ChatGPT. Future research on similar topics should aim at a broader understanding of public sentiments and perceptions of GenAI under different language and cultural settings.

In this study we were interested in identifying the perceived affordances of GenAI as presented in the data. The formation, process of actualization, and effects of each GenAI affordance are left to future research. Scholars have observed that technology affordances are powerful predictors of behavioral outcomes such as engagement, flow experience, and continued use in contexts ranging from online video platforms to mobile games (Song *et al.*, 2021; Yang and Gong, 2021; Zhao and Wagner, 2023). Our findings provide a crucial steppingstone for researchers to combine the affordance perspective with other social and behavioral theories to advance the understanding of GenAI as a sociotechnical phenomenon.

Table 3 presents a sample of the possible questions to be addressed in future research.

Table 3 Questions for Future Research	
Primary goals	Examples of research questions
Gaining further insight into each layer of the hierarchy. Moreover, how will each layer of GenAI affordances evolve as the technology matures?	In addition to digital content generation, which operational affordances have emerged in the expanding landscape of GenAI? What are the new social affordances that will emerge, e.g., affordances related to organizational or hedonic uses of GenAI tools? Are human work augmentation and human work substitution mutually exclusive or co-existent? What is the nuanced relationship between these two motivational affordances? Will <i>human work creation</i> emerge as a motivational affordance to address new forms of human work, such as AI prompt engineering, ushered in by GenAI?
Understanding the formation, actualization, and effects of GenAI affordances	Does the formation of higher level GenAI affordance perception require actualization of lower-level affordances first, or could the higher-level affordance perception form based solely on perception of lower-level affordances? How do factors such as individual characteristics, personal beliefs, social norms, experience with internet technologies in general, and prior knowledge of AI affect a user's perception of GenAI affordances at each level? Given that a social affordance depends on a relationship between humans, how does a social affordance interact with other crucial social constructs such as trust in determining user behavior? What factors may influence the success or failure of the actualization of GenAI affordances at each level? Which level of GenAI affordances has the biggest impact on user behavior such as acceptance and continued use?
Exploring GenAI affordance under unique contexts	Are there uniquely salient affordances under the specific context of different GenAI application domains, e.g., education, marketing, healthcare, and metaverse gaming? Can existing or new theoretical constructs and frameworks help explain the mechanism and predict the outcomes of GenAI affordances under each unique context? For example, do educational affordances of GenAI impact learning outcomes through the mediation of student engagement?
Developing guidelines for practice	How can we develop guidelines on various aspects of GenAI implementation, including technology features, policies and procedures, user training, and regulations, to better align with the GenAI affordances? For any negative affordances of GenAI, how can we mitigate the undesirable outcome during design and implementation of specific GenAI applications?

CONCLUSION

GenAI is a disruptive technology that will impose profound economic, political, and societal impacts in the coming years. As one of the first investigations of the public mindset of a GenAI tool, the present study contributes to the literature by extracting the sentiments, emotions, and perceived affordances from the public discourse related to ChatGPT expressed on social media. The findings shed light on the key affordances of a GenAI tool aimed at broad usage by the entire global population. Our findings also contribute to the literature on technology affordance by confirming the validity of the hierarchical view of affordances. As another unique contribution of this study, we demonstrated that social media data is well-aligned with research on new technologies through the affordance lens. After all, “What can we do with it?” is one of the overarching questions addressed by the discussion of a novel technology on social media.

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INFLUENCER MARKETING AND THE EVERCHANGING DOMAIN OF SOCIAL MEDIA MARKETING

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ABSTRACT

Influencer marketing, digital marketing, and social media marketing are hot topics in the marketing world, especially among adolescents nowadays. However, the relationships among these concepts have not been investigated systematically. By definition, influencer marketing practitioners use people with large social media followings to influence their viewers on what they should buy. Opinion leadership is a type of influencer marketing and has been investigated to a degree in marketing as an opinion leader has an opinion or voice that others may value. These techniques have grown in popularity, especially among adolescents with the increased use of technology and social media in everyday life. Adolescents extended the activities of opinion leaders beyond the traditionally defined boundaries.

This research aims to investigate influencer marketing from the perspective of consumers of all ages, especially adolescents. Specifically, this research aims to analyze relationships among influencer, digital, and brand marketing to understand the domain of social media marketing. This paper offers a conceptual model and concludes with implications for managers and researchers.

INTRODUCTION

As time and technology have progressed, social media has become a pivotal part of society. Social media and the internet have allowed for quick and easy retrieval of information about numerous products on the market at an increasing rate. Many companies and products competing for a piece of the market businesses have been forced to become more creative and demanding in their advertising. Diving into the growing popularity of social media and video content, personalities were born, and businesses saw a chance to grow off of those personalities.

Historically, it is believed that the earliest influence marketers were the Pope or the Queen, who were said to promote medications for those who were not yet considered believers (Grin 2019). In 2018, Daniel Wellington, a watch company, was one of the most popular influencer accounts by receiving over 20,000 posts with the mention of #ad. Influencer marketing has played a considerable role in their company, helping it grow into the powerhouse that it is today. Daniel Wellington started sending watches to micro-influencers in 2015 in exchange for a mention in their post, which, in turn, helped generate over \$220 million in revenue in a single year (Huhn 2019). Paying attention to many niche markets can help develop new customers from various areas that a company might not have thought to reach out to before.

As for the future, the influencer marketing industry is expected to grow to \$15 billion by 2022 (Grin 2019). Consumer interest in influencer marketing has risen 90 times since 2013 and is only likely to continue to grow (Huhn 2019). Influencer marketing is viewed as more reliable than a traditional advertisement, and therefore more people are going to read the post and take its content seriously.

With growth comes greater attention from the public. A company does not have to be a major player to draw the public's attention, but the company needs to weigh the pros and cons of using influencer marketing. While influence marketers can attract lots of positive attention to a brand of any size, they can attract negative attention. Influence marketers can have total freedom to post what they want about a brand or post specific, guided updates depending on the made contract (Radoslav 2018). A famous, modern-day example of how the influence marketers can impact your brand in unexpected ways is the Colin Kaepernick scandal from Nike. In 2016, Kaepernick kneeled during the National Anthem at a football game in protest for the unarmed killings of people of color by the police (2019). Nike did not contract with Kaepernick thinking that he would do something like this that would come back and draw their brand into a controversial topic. Companies need to evaluate the people they are using as influence marketers to ensure that they continue to align with their brand's values.

This research introduces a model to organize the boundaries of social media marketing and better understand the relationships of concepts and implementations around this domain. The relationships among the concepts of influencer, digital, and brand marketing within the context of adolescents are discussed. As new concepts and implementation tactics are introduced to the market every day, this model may help research directions and analysis.

LITERATURE REVIEW

A rising trend among businesses on social media is influencer marketing. Bladow describes an influencer as “anyone who has the ability to impact someone’s purchase decisions” (Bladow 2018, p.1). Lin, Vijayalakshmi, and Lacznia define influencer marketing as people who “are famous in a field and have accumulated a large number of followers ... and often persuade followers through their authentic messages” (Lin, Vijayalakshmi, Lacznia 2019, p.1). Accordingly, a new definition of an influencer can be anyone who has a mass social media following where followers trust their opinion on what they should and should not buy.

Influencer marketing is different from opinion leadership. Opinion leaders are people one value their opinion, and this can be a friend or a celebrity. A perfect example is the use of celebrities sponsoring fitness and dietary supplements (Belyh 2018). The viewer might not know the celebrity personally. Still, they value their opinion, and so they too go out and purchase the same supplements because they believe in what the celebrity is posting (Belyh 2018). Opinion leaders have experience or expertise in a specific field and are not necessarily celebrities. Influence marketers are usually celebrities and paid to promote a brand or product and share the content of that product with the world. What they say in the content is not necessarily their true feelings or opinions on the matter. What sets an opinion leader apart is that they are experts in their field and can give opinions and facts to the consumers without input or pressure from brands.

Influencer marketing is used in a multitude of different platforms and creative content. These platforms include all social media, the most popular of which are YouTube, Instagram, Twitter, Facebook. The divisions of this innovative content range from beauty, health,

subscription boxes, and food; anything that the Influencer's audience would be interested in and matches their original content. A marketer's goal using an influencer on social media is to build brand awareness through other people's platforms. By doing so, marketers can reach a whole new audience that traditional advertisements might not get.

An adolescent is defined as a person transitioning into adulthood and aged between 13 and 19 years old (2020). Adolescents are a vast and easily accessible target because today's children are connected more than ever before. In America alone, 52 percent of tweens have their tablet, 41 percent have smartphones, and 23 percent have laptops (Tolbert, Drogos 2019). Something else that makes adolescents vulnerable is their age and lack of awareness of whether the information they are consuming online is the truth. Adolescents are at a very impressionable age, so when they are viewing a video or a post on Instagram featuring a specific product being promoted by a particular influencer, they are not able to decipher if what the person is saying is truthful, or they are just being paid to say these things.

In the age of technology, it is getting harder and harder for parents to keep the internet and social media out of their children's lives. It has been shown that adolescents take what influence marketers say as honest and trustworthy, which causes moral and ethical issues among parents and companies. There may be a connection between how parents view influence marketers and how their children will perceive them. Lin, Vijayalakshmi, and Laczniaik say that "poor understanding of Internet ads in parents results in ineffective as-related discussions with their children" (2019, p.1). In addition to a lack of understanding from the parent's end, the lack of development on behalf of the children viewing online videos can lead to wishful identification. Wishful identification is the "psychological desire to be like a media personality" which can later manifest in adolescents imagining themselves as the personality they are watching or going as far as to imitate them (Tolbert, Drogos 2019, p.2).

Online endorsements are monitored by the Federal Trade Commission (FTC). They "establish broad principles that govern endorsement disclosure requirements and provide the FTC's interpretation of (...) the use of endorsements in advertising" (Bladow 2018, p.1). Bladow also states that "to date, the FTC's enforcement actions have failed to effectively address the nondisclosure of endorsements in the affiliate marketing industry" (2018, p.1). With the rise of influencer marketing and the more relaxed enforcement from FTC, children are at even more risk of consuming various advertisements without their knowledge.

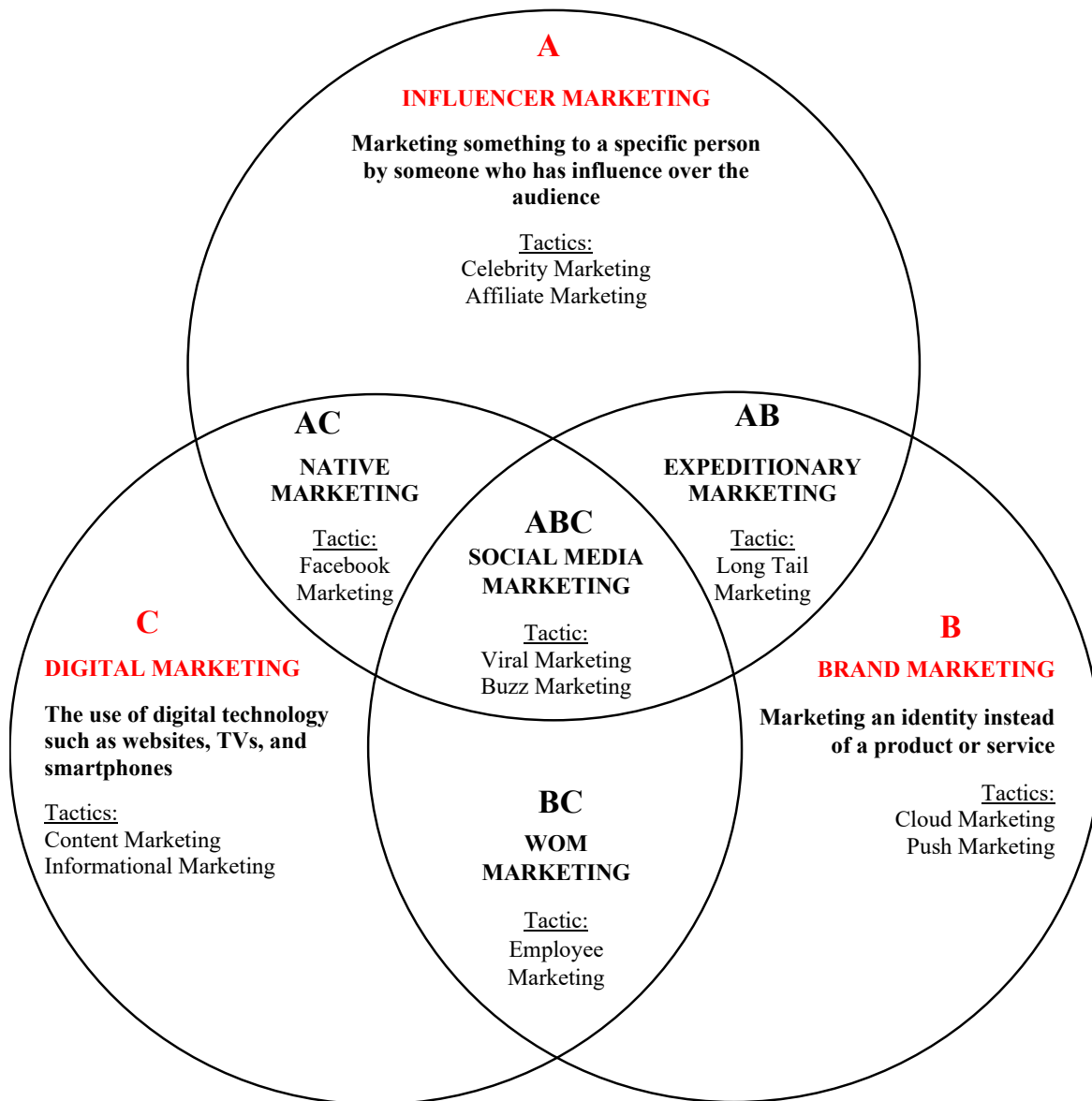
As video and social media content become more popular among youths, influencer marketing sounds like it could be suitable for brands that target younger audiences. By using personalities and characters that the young viewers love to persuade them to buy certain products, brands can expand their markets and grow their sales. Despite the perceived benefits for the companies and advertisers, there is concern about how influencer marketing is affecting adolescents. The purpose of this paper is to propose a conceptual model of social media marketing and explore the effects of influencer marketing on adolescents. This modal may allow the elaboration of influencer marketing, digital marketing, and brand marketing.

RELATIONSHIPS AND SOCIAL MEDIA MARKETING

Social media marketing literally uses online social platforms, like Instagram and Facebook, as a marketing tool. Social media advertisements can range from paid posts, free promotion from happy consumers, and even employees' opinions and posts. Today social media marketing has almost become synonymous with influencer marketing which is the use of a

person or groups of people and their power to persuade their followers to use or buy a particular brand or product. Social media marketing can be boiled down to a mix of influencer marketing, brand marketing, and digital marketing. Figure 1 introduces the relationships between these marketing tactics shows the interconnectedness of these three topics and how they interact. Each main section is labeled in Figure 1 as A, B, and C. Interactions among these sections are marked as AB, AC, BC, and ABC. Also, examples of everyday tactics that are used in recent marketing activities are discussed in each section. Section discussions are concluded with propositions for future research.

FIGURE 1 – RELATIONSHIPS IN SOCIAL MEDIA MARKETING



Section A represents influencer marketing that can be defined as using anyone who has a mass following, where followers trust their opinion on what they should and should not buy (Lin, Vijayalakshmi, Lacznia 2019, Bladow 2018). One way to achieve influencer marketing is through celebrity marketing, which uses a famous person to endorse a product or service (2020). Affiliate marketing also relates to influencer marketing by paying an affiliate or partner for each referral of a new customer that they bring in (Gregori 2014). An early influencer from 1931 is Santa Claus, depicted as a spokesperson for Coca-Cola (2019). A more modern example is Khloe Kardashian, who promotes FabFitFun boxes (2019).

Section B represents brand marketing, which is the art of marketing a brand's identity, which helps depict what a brand stands for in the social and business world (2020). With the vast technological advances of the 21st century, cloud marketing is also an effective way to market a brand through modern tools like email and social media (2020). Push marketing is an aggressive form of marketing that pushes a product or service onto an audience who might not know about the product previously (2020). Push marketing can also be used to make a brand's image or position on a topic onto their markets. On the other end of the spectrum is pull marketing, which creates interest without being intrusive, like forming a Facebook group for a company to deliver content to a specific group of interested individuals who want to receive it (2020). At Home's Snapchat stories, they show videos of different do-it-yourself projects that happen to use At Home items and colors, but they do it in a way that seems natural.

Section C represents digital marketing, which is defined as a way to promote products online and through various digital channels like websites, email marketing, and display ads (Sherman 2019). Digital marketing was born with the World Wide Web and Netscape invention in 1994 (Simon 2019). As the internet grew in popularity, brands started to market themselves online via new Search Engine Optimization (SEO) techniques and email marketing (Simon 2019). Content marketing, which is "creating and distributing content to drive positive action," plays a role within digital marketing via the content that brands create online (2020). Informational marketing explains precisely what a product is, how it works, and its benefits, which fits into digital marketing because the use of the internet makes it easier for informational content to be created and distributed (2020).

Section AB is called Expeditionary Marketing and the overlap of Section A (Influencer Marketing) and Section B (Brand Marketing). Expeditionary Marketing can be described as marketing for growth in the form of risk-taking to achieve the goal of expanding into a new market or the successful use of new marketing tactics (2020). This happens in today's market when established companies break into a new market and might be unexpected for that specific brand. Expeditionary marketing can be highly successful if done correctly.

Long Tail marketing refers to targeting small, niche markets with a specific product or service that may happen when a company's current market is controlled by a larger company inhibiting growth (2020). An example of long-tail marketing is the recommendations that you receive on websites like Amazon. The items that pop up in your recommended section might have nothing to do with what you were searching for and is an example of how companies target a niche market. On the opposite end of the spectrum is mass marketing, marketing a product intending to sell it to the largest number of people possible (2020). An excellent example of mass marketing is Wal-Mart because they aim to sell their products to everyone that they can, not having a narrow market in mind. This discussion leads to the following proposition:

- P1: Companies that target smaller, niche markets might have better luck at creating a robust and loyal customer base which, in turn, allows their company to hold a stake in that particular area.*

Section BC is *Word of Mouth Marketing* and is the overlap between *Section B* (Brand Marketing) and *Section C* (Digital Marketing). Word of Mouth Marketing (WOM) has long been an established part of the marketing world and is highly relevant in today's world of the internet. WOM is when customers recommend a product or service, or company for any reason and, in return, the name of the company spreads (2020). An example of WOM is when a commercial stands out in a certain way, like the puppy-monkey-baby Mountain Dew commercial from the Super Bowl. People saw that as wildly out of the ordinary, and in turn, were talking about it to their friends, spreading the name of Mountain Dew as they went.

Employee marketing is the subliminal use of employees to market a brand or company; since employees are ambassadors of the companies' work, they can spread the word about the company (2020). Employees can always share what happens in the workplace with their friends and family in person or online. This insider view means that they can praise the company they work for because they feel like the company is doing a great job, or they can air their grievances online to the world whether the company was intending for this or not. Consumers take what employees say to heart, and that can have a significant impact on the company. Online and offline marketing are also variations of WOM marketing. Online marketing is any marketing that takes place online, like social media and websites; people can also spread and share posts and links (2020). Offline marketing takes place off the internet when people talk to one another or see an advert on a paper flyer or billboard (2020). People are the most abundant type of advertising:

- P2: Word of mouth marketing is a reliable way for companies and businesses of any size to get their products out into the world while relying on a free service that their clients perform.*

Section AC is the overlap between *Section A* (Influencer Marketing) and *Section C* (Digital Marketing). *Native Marketing* is the placement of advertisements with a similar look to the surrounding content (2020). The ads seen at the top of a Google search page are native; they don't look like ads except for the little green box, which indicates it is an ad (2020). The six main types of native marketing are in-feed units that promote a brand within its website, promoted listings, paid search ads, recommended widgets, custom ads, and in-ad native element units (2017). Native Marketing is relevant now more than ever with the increased use of social media.

Email marketing is a perfect example of native advertising. Email marketing is the use of email to send customers important information and offers (2020). Emails that people receive from companies look just like a regular email that they receive from a friend, which allows the advert to blend in with its environment. Product placements are also an excellent way to display native advertising. Product placements occur in movies, TV, and online videos when a particular product or brand is prominently displayed for the viewer to see. Still, it does not stick out from its surroundings. The opposite of native advertising would be pop-up advertising. Pop-up ads frequently occur on the Internet and do not try to hide the fact that they are advertisements. Sometimes the easiest way to get people's attention is the subtlest:

- P3: Native advertising does not have to be in the consumers' face or expensive. Instead, it can be subtle, like an email or from Search Engine Optimization (SEO).*

Section ABC is Social Media Marketing, where influencer marketing, brand marketing, and digital marketing come together. When companies utilize digital marketing in a variety of ways, they might also venture into influencer marketing. While digital marketing alone might reach a wide range of consumers, influencer marketing will open to a whole new market and create new demand for the product. Influencer marketing and brand marketing can also go hand in hand. When a brand chooses an influencer, they say that that person aligns with the brand's personality. Companies that utilize brand marketing, influencer marketing, and digital marketing can achieve overall social media marketing. Social media marketing is marketing through multiple social media platforms (2020). YouTube is a popular platform that is used for influencer and digital marketing.

Buzz marketing plays a prominent role in social media marketing because it creates excitement through outstanding marketing efforts and messages (Rollins et al., 2014). An example would be the Taco Bell hotel in the summer of 2019, where influence marketers and some lucky fans got the chance to stay for a weekend at a hotel made by the company. The Taco Bell Hotel was a limited-time event that was not open to the public but instead played a role in promoting the brand and some new products. This event created a lot of buzz and eventually went viral, which is the next step. Viral marketing is when something becomes popular between consumer-to-consumer communication (Rollins et al., 2014). When good social media marketing is done, it leads to the development of buzz and viral marketing.

In both the traditional and online sense, word of mouth marketing is the modern, popular way for the public to receive their information and form opinions. WOM is developed in the traditional sense through people communicating via phones, newspapers, or face to face (Rollins et al., 2014). Traditional WOM marketing is similar to how news circulated before the invention of the Internet when people were dependent on each other's opinions to help form their own. Buzz marketing is when a company or consumer creates a compelling message that leads to many people talking about it (Rollins et al., 2014). The company can also intentionally make something called word-of-mouth marketing, meaning that a company creates its buzz and is then shared by the consumers on the Internet, leading to viral marketing (Rollins et al., 2014).

Businesses should also be aware that opinion leaders play a role equal to influence marketers. An opinion leader has a unique perspective of products and can communicate with the customer differently. Simon Moores is an opinion leader because he has experience in his area, which gives him credibility with consumers and the public (Influencer Marketing Hub, 2019). Moores is not a typical celebrity, but his words influence because of his expertise in his area.

Today's consumers have started to dismiss traditional forms of marketing like commercials and paper ads to influence marketers on YouTube and social media (Gerdeman 2020). The process behind influencer marketing is quite simple. All a company needs to do is identify a popular influencer in a specific market segment, give them a product or payment, and create content that encourages their viewers to purchase that product (Richardson 2016). An important thing to note is that an influencer in one space might not be an influencer in another area, so it is essential, as a company, to research their market (Richardson 2016). Anyone that has a connection to the Internet has the chance to post their opinions about whatever product or company they feel like, and it has the opportunity to gain traction and support from thousands of people around the world. It does not matter where they are or what their interests are; there is a target market for everything, and because of this power:

P4: Anyone can be an influence marketer no matter what their area of specialty is or age range.

Influencer marketing can be a very effective tactic when dealing with a younger audience like adolescents, but it should also be done with care. When asked, 24 percent of tweens: children aged 9 to 12, were reported saying that they watch their favorite YouTuber every single day of the week, and another 40 percent reported that they watch for more than 1 hour each day (Tolbert, Drogos, 2019). It appears to be that tweens are consuming upwards of an hour's worth of persuasive content daily. Adolescents are still developing, and therefore they lack the skill of advertising literacy (van Dam, van Reijmersdal, 2019). YouTube is a vast market for influencer marketing because the advertisement of a product or service can be weaved in seamlessly into the content. This appearance of genuine content can be dangerous for the children who are watching because they might not decipher the difference between honest opinions and advertisements.

Children can recognize brands as early as 3 or 4, and they develop further to begin and make abstract connections between the product, brand and associate the product with different things (Achenreiner, John, 2003). These connections can be good or bad news regarding influencer marketing and the companies that utilize it. Adolescents who are subject to influencer marketing see them as role models and accept their behavior and attitudes (van Dam, van Reijmersdal, 2019). Since advertising literacy is less easily triggered at their age, the influence tends to work better, which will, in turn, create more sponsorships for that influencer and so on (van Dam, van Reijmersdal, 2019). While this plays in favor of brands, parents might not accept the deception that their children are undergoing.

To protect consumers, especially adolescents, the Federal Trade Commission (FTC) requires clear disclosure of a material relationship between brands and influence marketers (Bladow, 2018). Clear disclosure is vital, so consumers understand that what they are about to witness is a paid or sponsored advertisement. While influencer and social media marketing are essential for companies who want to increase their presence and sales, it can be a slippery slope when dealing with adolescents and their parents. As a result, companies can gain a positive reputation in parents' eyes if they continue to have transparent marketing practices with the adolescents and children they target.

MANAGERIAL IMPLICATIONS

Business-initiated influencer marketing is an increasingly growing field that can give enterprises several advantages. Among the 192 marketers and agency professionals surveyed, 57 percent said that they were going to increase their influencer marketing budget this coming year (Zeng 2020). An easily seen benefit of influencer marketing is the wide range of influencers marketers can choose from. Ranging from micro-influencers with as few as 5,000 followers to macro-influencers with over 100,000 followers, 77 percent of marketers are interested in micro-influencers (Zeng 2020).

Viral marketing has the chance to play a crucial role in influencer marketing. Viral marketing can be described as a combination of WOM, buzz marketing, and online marketing (Rollins et al., 2014). WOM, as discussed before, is a crucial tactic to be utilized in not only viral marketing but also influencer marketing. WOM ties into viral marketing because when a marketing message is circulated on the internet and is talked about frequently, it can become viral on and offline (Rollins et al., 2014). Influence marketers can achieve the same status depending on the content that they create. Their wording to the activities that they perform on

social media and video can all play into their content, and in turn, a company's content, going viral.

Buzz marketing creates excitement through a noteworthy marketing campaign (Rollins et al., 2014). Buzz marketing can happen at any time under any circumstances, whether the creator intended it or not. The goal of most influence marketers is to have their content grow in popularity so that they can grow their influence and hopefully get more brand deals. To achieve the buzz through viral marketing, influence marketers should have the goal to create content that makes people want to talk about it, and in turn, talk about the products or brands associated with them.

Online marketing is the last key factor that relates to influencer marketing and buzz marketing. As a recap, online marketing uses the Internet and other online sources like banner ads to facilitate marketing plans (Rollins et al., 2014). What makes online marketing so crucial is the widespread use of online platforms for several purposes, which presents various marketing opportunities. The Internet has lowered entry barriers for smaller businesses, enabling them to enter the marketplace, which means that small businesses will gain from influencer marketing (Rollins et al., 2014). Firms of all sizes struggle with brand loyalty, and some tend to stay in niche markets which depletes their use of buzz or viral marketing (Rollins et al., 2014). Since all firms struggle with loyalty, influencer marketing might be vital in developing stronger brand loyalty. If someone sees their favorite influencer supporting a specific brand, there is a good chance that they too will purchase this product and continue its use in hopes of becoming more like that influencer.

Viral marketing, marketing that occurs from word of mouth marketing, also plays a role in influencer marketing (Rollins et al., 2014). Viral marketing and influencer marketing can go hand in hand. Influence marketers can go viral, and that is something that companies need to keep in mind as well. A single post from Facebook has the chance to reach thousands of people (Rollins et al., 2014). In the modern-day world of constant creation of social media content, companies need to be aware of the content published with their name on it.

Opinion leadership and influencer marketing go hand in hand. Dr. Oz is a perfect example of the powerful influence that opinion leaders have over their viewers. Dr. Oz, a physician turned wellness advisor, gained fame through his many books and famous TV, landing him on *TIME's* '100 Most Influential People of the Year and Century Lists' (Schein, 2018). His popularity has placed him front and center, which has led him to become a go-to for medical advice even after it was revealed that 60% of his advice lacked scientific backup (Schein 2018). Oz has continued to grow his platform and has become a spokesperson for RealAge.com, a website that allows the user to take a quiz to determine their 'real age' and discover ways to reverse and improve their aging. Due to his extensive time in the medical field, Dr. Oz has become a trustworthy person to seek medical advice despite the evidence that has been presented against him.

Comparatively, Dr. Fauci, Director of the National Institute of Allergy and Infectious Diseases, is considered the lead doctor for the Coronavirus outbreak (NIAID, 2020). He is also strictly an opinion leader. The difference between Dr. Fauci and Dr. Oz is that the former is not actively doing any marketing in a commercial way for a product, service, or company. Dr. Oz not only can give opinions and suggestions for people to do certain activities, but he can also provide examples of products and services because he is also an influence marketer.

RESEARCH IMPLICATIONS

A common assertion of influencer marketing is that their endorsements are more authentic than messages given by traditional celebrities and carry more weight than a peer recommendation (Bladow 2018). While there is academic research that backs up the idea that adults can perceive what they see and make decisions for themselves, adolescents cannot do the same. The brain of adolescents is not fully developed in the areas that allow them to make decisions and judgments that are thoroughly thought out, and this affects their advertising literacy; the ability to see content as an advertisement instead of being truthful (van Dam, S., & van Reijmersdal 2019). The information provided to adolescents is seen as facts and causes them not to question influence marketers much. This paper established the conceptual possibility that influencer marketing might significantly affect adolescents consuming their content instead of their parents. This brings up the question: how can we research what does and does not work in the market from the viewpoints of parents, children, and both together?

Investigating this assumption would require an in-depth qualitative research analysis that needs to be studied to understand better how influencer marketing works with modern-day adolescents and their parents. Methods of research could vary from a case study to focus on groups to achieve the desired information. Current companies like Glossier, The Honest Company, and Target participating in influencer marketing can be researched to create their influence on marketing campaigns (Wheeler 2016). These companies should follow the current model described in this paper as close as possible to entertain all aspects of social media marketing to their advantage. The content created via the influence marketers that the companies pick would then be viewed and analyzed by a group of adolescents and their parents separately. The first metric would be to see if adolescents and their parents can decipher a sponsored influence marketer from a regular influence marketer who uses products in their videos. The second metric would measure whether they felt the influence marketer was open and honest about using the product or if the viewer felt that they were deceiving the audience.

After creating content that is adequate in meeting both metrics, companies would be able to choose the right influencer to meet their needs. For instance, if their goal is to reach children between 9 and 12, they should try shifting towards YouTube as that age range is the fastest growing audience on that platform (Tolbert and Drogos, 2019). Companies would also revise their agreements with their current influence marketers to match the results found in the earlier focus groups and case studies. Companies could also use this time to determine if they need to focus on parents, who are the gatekeepers, rather than the adolescents they might have previously been targeting. Making this change might favor the company because the parents might no longer feel like their children are being targeted unknowingly online.

Parents are not only the gatekeepers, but with all of the new advances online, they are also having issues navigating the online marketplace. Certain aspects of parents' online usage have been less effective as they navigate the online world, reflecting on their children (Lin, Vijayalakshmi, and Laczniak 2019). This means that the way parents perceive the ads targeted towards their children is vital because they will most likely influence their children's responses to the same ad (Lin, Vijayalakshmi, and Laczniak 2019). Children may have access to online advertisements, but ultimately, the parent decides to purchase things for their children. If they have a negative attitude towards the company, they are less likely to buy that product for their children.

Companies would then follow up regularly on their performance after initiating their changes. At this time, they would disclose any changes in followings or revenue that could prove or disprove the accuracy of these shifts when target audience surveys could be sent out to see how their clients view them. Search engines may also help compare the number of positive versus negative searches performed on the companies.

Though influencer marketing has been around for decades, it has become popular in recent years and has changed drastically from what it used to be. While we provide a model (*Figure 1- Relationships in Social Media Marketing*) for managers, this model is untested and conceptual. However, it revealed the fact that the domain of social media marketing is changing and spreading fast. The influence of adolescents in this domain is significant but not investigated enough. Future researches will provide relevant, beneficial insights into this topic.

CONCLUSION

Influencer marketing has the chance to expand a company's audience, thereby increasing profits. It allows companies to play a role in the content consumed daily by millions of people across the world and ease their way into the viewers' minds. Any company can participate in influencer marketing to gain favor or preference in the eyes of the consumer. Small companies may use influencer marketing to get good word of their company into the marketplace and gain footing in their particular target market. Larger companies may use influencer marketing to create new customers and expand into previously uncharted market areas. This paper has investigated the effects of influencer marketing on adolescents, proposed a conceptual model, and provided the implications for research. Influencer marketing is a powerful tool that is widely used daily by numerous companies and influence marketers. Managers can create successful influencer marketing campaigns if they are familiar with the basics of social media marketing. The symbiosis between a good product and an honest influencer can create the ideal influencer marketing campaign for any company.

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EMERGING MOBILE PAYMENTS' CHALLENGE TO TRADITIONAL PAYMENT SYSTEMS IN CHINA: A CHINESE CONSUMERS' PERSPECTIVE

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ABSTRACT

Mobile payment has accelerated the banking industry's transition toward greater payment mobility, particularly in China, where Alipay and WeChat Pay have become deeply embedded in everyday consumer transactions. This study examines Chinese consumers' comparative evaluations of mobile payment and traditional/card payment across seventeen salient payment-service attributes. Rather than treating mobile payment as an adoption-only phenomenon, the study develops a comparative perceived-value framework in which payment preference is shaped by convenience/mobility, operational reliability and risk protection, financial-credit value, and ecosystem/institutional fit. Using survey data from 92 Chinese respondents, the analysis compares paired evaluations of mobile and traditional/card payment systems and identifies the attributes and construct domains that distinguish the two payment modes.

The results show that respondents evaluated mobile payment more favorably on convenience/mobility and selected operational-performance attributes, including safe to carry and make payments, convenient way to make payments, accurate payment transactions, and interest on deposited balance, whereas traditional/card payment retained advantages on selected financial-credit value and reliability/protection attributes. Attribute-level logistic regression and random forest classification indicate that payment-mode distinction reflects a combination of convenience/mobility, operational reliability and risk protection, and financial-credit value rather than a single dominant factor. A secondary construct-level logistic regression provides exploratory evidence that convenience/mobility is positively associated with mobile-payment classification, while operational reliability and risk protection and financial-credit value are more strongly associated with traditional/card payment observations. Exploratory factor analysis of the seventeen mobile-minus-traditional/card difference scores identifies three empirical dimensions: payment accuracy, safety, and convenience; financial incentives and borrowing value; and transaction monitoring and credit-cost benefits. The findings suggest that mobile payment's dominance in China rests primarily on convenience, mobility, and operational performance within a supportive platform ecosystem, while card-based systems retain comparative value in financial-credit and selected risk-protection features. The study contributes an exploratory, theory-informed framework for understanding how consumers compare payment systems in a mature mobile-payment environment.

Keywords: *Mobile payment in China, Card payment in China, E-commerce in China, Mobile commerce, Digital Banking platforms in China.*

INTRODUCTION

In recent years, the rapid development of mobile payment in China has provided consumers and merchants with faster, easier, and lower-cost retail payment options. Led by Alibaba's Alipay and Tencent's WeChat Pay, China has become one of the world's largest mobile-payment markets. Mobile payment is now so common that foreign visitors who rely on cash or cards may find it difficult to complete ordinary purchases. One author observed this during travel in China, where even small vendors and train attendants often expected customers to pay through mobile phones rather than cash or credit/debit cards. These observations motivate the study's central question: how do Chinese consumers evaluate mobile payments compared with card-based payment systems?

Much prior mobile-payment research examines adoption, acceptance, or continuance intention. This study instead examines mobile payment as a comparative payment-system evaluation. It asks why consumers may prefer one payment system over another when they compare convenience/mobility, operational reliability and risk protection, financial-credit value, and ecosystem/institutional fit.

The contribution of this study is to compare mobile payment with traditional/card payment across seventeen salient payment-service attributes in China. This approach identifies where mobile payment creates comparative perceived value, where card-based systems retain advantages, and how broader construct domains organize these preferences. The China setting is especially useful because mobile payment operates within a distinctive platform ecosystem shaped by QR-code acceptance, mobile-wallet infrastructure, merchant adoption, and regulatory oversight.

LITERATURE REVIEW

Recent Bank for International Settlements (BIS) Red Book commentaries document a sustained global shift toward more digital, faster, and platform-based retail payments, while also showing that cash remains functionally relevant in many economies. Across CPPI jurisdictions, cashless payments have grown rapidly, especially in emerging market and developing economies, driven by card payments, credit transfers, e-money, fast payments, and non-bank payment accounts. These commentaries suggest that digital payment instruments often complement rather than fully replace cards, while cash increasingly shifts toward a residual or precautionary role (Kosse, Szemere, & Di Iorio, 2023; Di Iorio, Kosse, & Szemere, 2024; Di Iorio, Kosse, & Mustafi, 2025).

China fits this global pattern but exhibits a more pronounced mobile-first configuration. QR-code-based mobile payments through large non-bank platforms such as Alipay and WeChat Pay dominate everyday transactions, while bank cards increasingly serve as underlying funding instruments rather than front-end payment tools. This structure has been shaped by regulatory

measures governing non-bank payment institutions, reserve-fund management, QR-code standards, data governance, and user protection. The 2023 Non-bank Payment Institutions Supervision Regulation, effective in 2024, further elevated oversight of non-bank payment providers and reinforced their role in small-value, convenient retail payments (State Council of the People's Republic of China, 2023). These developments strengthen the manuscript's ecosystem/institutional-fit argument by showing that consumers' payment preferences are shaped not only by payment attributes but also by the institutional infrastructure that supports mobile wallets, cards, and cash.

While many U.S. banks and credit-card issuers invested heavily in card-security upgrades and chip-enabled cards, China moved rapidly toward mobile payment and developed one of the world's largest digital-payment markets. In China, mobile payments are now widely used across retail purchases, person-to-person transfers, and many business-to-business transactions.

China's mobile-payment system is built on digital wallets and QR codes and is dominated by two private technology firms: Alipay, operated by Alibaba, and WeChat Pay, operated by Tencent. These platforms connect payment services to e-commerce, social networking, and other digital services, making mobile payment part of a broader platform ecosystem rather than a separate payment instrument (Klein, 2020).

Recent evidence from experienced WeChat Pay users further supports this platform-ecosystem interpretation. Hong, Wan, and Yao (2026) find that trust, network externalities, red-envelope features, and interface design significantly shape users' continuance intention toward WeChat Pay, suggesting that mobile-payment use in China is sustained not only by payment functionality but also by social-platform integration and app-specific value features.

As mobile payment gained wider acceptance among Chinese consumers, the relative role of cash and bank-card transactions declined. The People's Bank of China reported that mobile-payment transactions accounted for substantial shares of total payment activity, while cash and card payments represented smaller shares. Cash remained more common in areas where formal financial services were less accessible. Cash and bank-card management also impose costs on consumers, merchants, and the banking industry, including card and currency production, transportation, deposit and withdrawal processing, identification, destruction, and counterfeit prevention (People's Bank of China, 2021; eMarketer, 2021).

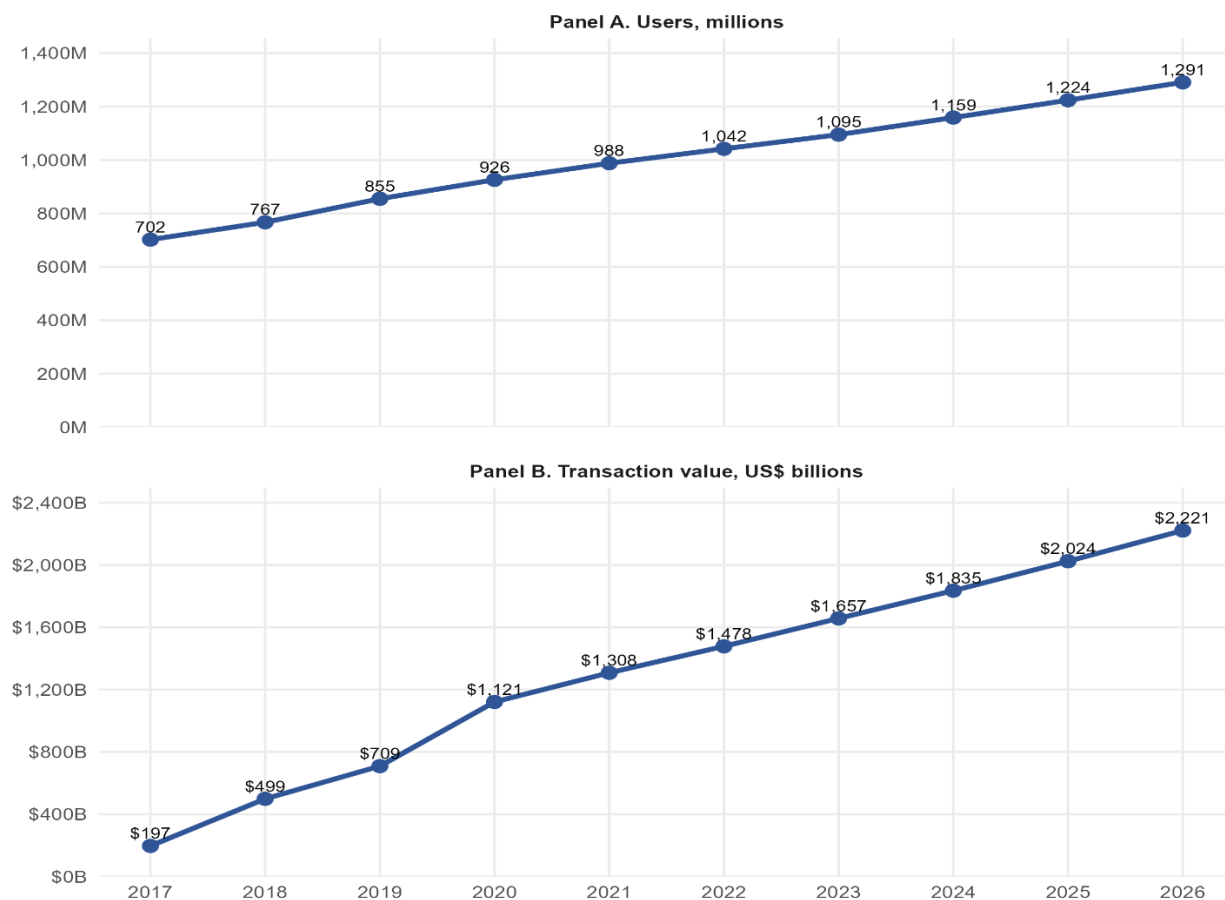
The introduction of Alipay in 2004 marked an important stage in China's shift from cash-based transactions toward mobile and digital payments. QR-code payment systems reduced transaction costs and allowed sellers and buyers to complete transactions by scanning payment codes rather than relying on traditional point-of-sale card terminals (Consultative Group to Assist the Poor, 2019).

Alipay and WeChat Pay were able to build on China's existing financial infrastructure, including bank accounts, bank-card linkages, clearing systems, and settlement systems, while extending those infrastructures into app-based digital-payment ecosystems (Demirgüç-Kunt et al., 2022). This helped mobile-wallet providers reduce onboarding barriers because users could link mobile-payment wallets to existing bank accounts or cards rather than relying on a wholly separate payment infrastructure. Alipay and WeChat Pay pushed mobile wallet use further by creating a strong customer-value proposition in which payments functioned not as an end in

themselves but as a gateway to a broader digital ecosystem of products and services. Mobile-payment apps connect users to financial services, such as investment and insurance products, e-commerce services, bill payment, travel booking, taxi hailing, grocery delivery, and other offline and online transactions. In this ecosystem, customers self-enroll through the app, and sellers can begin accepting digital payments by sharing an individual QR code even before registering formally as merchants. This lowers the barrier for experimenting with digital payments and has helped many merchants make the transition. As merchant volume increases, providers typically request additional information to deepen customer due diligence (Consultative Group to Assist the Poor, 2019).

Figure 1 presents two facets of China's mobile-payment growth: user growth and transaction value trends. Together, the two panels show both the expansion of mobile-payment users and the rapid growth of transaction value, providing market context for the consumer-level comparisons analyzed in this study. Mobile payment offers consumers and merchants several practical advantages, including speed, convenience, mobility, and lower transaction frictions relative to many traditional payment options.

Figure 1
Mobile Payment Growth in China, 2017–2026



Source: Constructed from Statista (2022).

To expand mobile-payment market share, the two technology platforms adopted a relatively light approach to transaction fees in order to reduce pricing and behavioral barriers for merchants. If a merchant's monthly transaction volume is below a specified threshold, Alipay and WeChat Pay may refund commissions, whereas merchants above the threshold pay between 0.6% and 1% of transaction value. By comparison, processing fees charged by U.S.-based card issuers can exceed 3%, which can be burdensome for merchants (Mosteller, 2020). This fee structure attracts small merchants who can use the service at low cost while also generating fee revenue from high-volume users. It is designed not only to earn transaction revenue but also to encourage users to hold funds in mobile wallets and spend within the platform ecosystem. These ecosystems also generate data on user preferences and spending patterns, which can support marketing, product development, merchant credit, and other financial services underwritten partly on the basis of payment and platform data (Consultative Group to Assist the Poor, 2019).

Sleiman et al. (2021) examine the government's role in safeguarding the mobile-payment sector and identify factors that influence consumer acceptance, including trust, mobility, perceived risk, perceived enjoyment, behavioral intention, security, and reputation.

Hosain and Kamal (2024) extend this consumer-acceptance literature by examining Chinese users of WeChat, Alipay, and UnionPay mobile-based electronic payment apps. Their results show that perceived ease of use, perceived usefulness, perceived trust, social influence, and peer influence positively affect adoption intention, while perceived risk and privacy were not significant predictors, reinforcing the importance of usefulness, trust, and social-platform context in Chinese mobile-payment adoption.

Related evidence from China's mobile-banking context also supports the importance of institutional and infrastructure conditions. Mensah and Khan (2024) find that performance expectancy, effort expectancy, perceived financial cost, awareness, technology infrastructure support, and government support influence behavioral intention and adoption of mobile banking services in China, reinforcing the relevance of ecosystem/institutional fit in digital financial-service adoption.

Xu (2017) examines the perceived added value of mobile payment through WeChat Pay for Chinese consumers. These value-added features include time savings, mobile-phone recharge, money transfers, merchant payments, investment-related services, and user incentives similar to cash-back or reward programs offered by credit-card companies in the United States.

The widespread use of smartphones created the technological foundation for mobile-payment adoption. Several studies from the early adoption period of mobile payment show that technology firms were important innovators. Shortly after Alibaba was granted a mobile-payment license, it focused on factors likely to motivate consumer acceptance, including usefulness, ease of use, trustworthiness, security, reputation, reliable transactions, and lower merchant costs (Gerhardt et al., 2010; Nijssen et al., 2016; Xin et al., 2015). Alipay and WeChat Pay have also worked with government authorities to improve the effectiveness and efficiency of mobile payment in China. This third-party payment system evolved through technological innovation and user-friendly operations, and it now handles large volumes of payment transactions relative to traditional banks and card issuers (Huang et al., 2020).

Prior research also helps explain why many Chinese businesses were slower to implement credit-card processing systems. Merchant resistance is often linked to processing charges by Western card issuers, which can exceed 3% of transaction value. This helps explain why credit cards were slower to gain popularity and were often more common in tourist areas. In addition, Chinese consumers may view credit-based purchases cautiously, especially when later payments are subject to interest. Major Chinese banks are state owned, and many consumers historically lacked formal credit histories, reducing incentives for widespread credit-card promotion. UnionPay has functioned as the main card processing network available to Chinese consumers, and many individuals hold debit cards with multiple banks (Consultative Group to Assist the Poor, 2019).

The literature shows that Chinese consumers evaluate mobile payment through multiple lenses, including usefulness, convenience, security, privacy, cost, trust, platform functionality, and institutional support. This study builds on that literature by comparing Chinese consumers' evaluations of mobile payment and card payment across seventeen payment attributes and by organizing those attributes within a comparative perceived-value framework. The goal is to identify which attributes favor mobile payment, which attributes favor card payment, and which broader dimensions organize consumers' comparative payment preferences.

THE STUDY

Prior U.S.-based empirical work has compared consumer preferences for mobile payment and card/conventional payment systems. That study found that U.S. respondents continued to favor card/conventional payments on several financial-incentive and credit-related attributes, while many other payment-service attributes showed no significant differences between the two payment modes (Chao & Dubas, 2026). The present China-focused study extends this comparative attribute-evaluation approach to a mobile-first payment ecosystem and develops a more explicit comparative perceived-value framework for interpreting consumer payment preferences.

This study addresses four research questions about how Chinese consumers compare mobile payment and card payment. It identifies seventeen salient payment attributes, compares consumer ratings across the two payment modes, determines which attributes and measured construct domains distinguish mobile from card payment, and examines the broader empirical dimensions that organize consumers' comparative payment preferences. The findings are useful for researchers, consumers, managers, banks, card issuers, and mobile-payment providers because they show how consumers weigh convenience/mobility, operational reliability and risk protection, financial-credit value, and ecosystem/institutional fit when evaluating payment systems.

The Comparative Perceived-Value Framework

The theoretical logic of the study is that consumers form payment preferences by comparing payment systems across benefits, risks, costs, and ecosystem fit. Mobile payments should be favored when consumers perceive stronger convenience/mobility, operational

reliability and risk protection, and integration with everyday digital services. Card payments should remain competitive when consumers perceive stronger financial-credit value, such as rewards, account-opening bonuses, purchase credit, or lower borrowing costs. Preferences are therefore not driven by a single adoption factor; they emerge from a comparative evaluation of what each payment system does better in a given national payment environment.

This logic can be expressed as a *comparative perceived-value framework* using two complementary equations. The first equation states the general comparative perceived-value model of payment preference, while the second expresses the mobile-minus-card/conventional difference model used in the empirical analyses.

$$PP = f(CM, ORP, FCV, EIF) \quad \text{eq. (1)}$$

$$\Delta PP = f(\Delta CM, \Delta ORP, \Delta FCV, \Delta EIF) \quad \text{eq. (2)}$$

In equation (1), the variables are defined as follows:

PP = payment preference;
 CM = convenience/mobility;
 ORP = operational reliability and risk protection;
 FCV = financial/credit value; and
 EIF = ecosystem/institutional fit.

In Equation (2), the variables are defined as follows:

ΔPP = mobile-minus-card/conventional payment preference;
 ΔCM = mobile-minus-card/conventional difference in convenience/mobility;
 ΔORP = mobile-minus-card/conventional difference in operational reliability and risk protection;
 ΔFCV = mobile-minus-card/conventional difference in financial/credit value; and
 ΔEIF = mobile-minus-card/conventional difference in ecosystem/institutional fit.

The propositional logic of this framework implies that increases in convenience/mobility, operational reliability and risk protection, financial-credit value, and ecosystem/institutional fit are expected to increase the perceived preference for the payment mode that performs better on those dimensions. In the mobile-minus-card formulation, positive differences indicate attributes or construct domains that favor mobile payment, whereas negative differences indicate domains that favor traditional/card payment.

Equation (1) summarizes the broader theoretical framework, while Equation (2) links the framework directly to the paired-difference structure used in the Hotelling's T^2 test, paired t-tests, and exploratory factor analysis. The classification analyses provide complementary attribute-level evidence about which ratings distinguish mobile-payment observations from traditional/card-payment observations.

The logistic-regression and random-forest analyses do not directly estimate the conceptual equations as structural models. Instead, the attribute-level logistic regression and random forest provide exploratory evidence about which individual attributes distinguish mobile-payment observations from traditional/card-payment observations, while the construct-level logistic regression provides exploratory evidence about whether the measured construct composites for convenience/mobility, operational reliability and risk protection, and financial-credit value distinguish the two payment modes. For the construct-level logistic regression, these three measured domains were operationalized as standardized composite indices formed by averaging the attributes assigned to each construct after internal reliability was assessed with Cronbach's alpha. Because ecosystem/institutional fit is developed as a contextual construct rather than a directly measured respondent-level index, these classification analyses are interpreted as limited empirical checks of the measured portion of the comparative perceived-value framework.

Research Questions

This study focuses on Chinese consumers' comparative preferences for mobile payment and card payment across effectiveness, efficiency, safety, security, privacy, service quality, and functionality. It addresses the following four research questions:

- RQ1. What are the salient attributes of banking and payment services for Chinese consumers?*
- RQ2. How do Chinese consumers' evaluations of salient mobile-payment attributes differ from their evaluations of card/conventional-payment attributes?*
- RQ3. Which salient attributes and measured construct domains are most important in distinguishing Chinese consumers' evaluations of mobile payments versus card/conventional payments?*
- RQ4. What underlying empirical dimensions describe Chinese consumers' mobile-minus-card/conventional payment preference differences, and how do these dimensions relate to the study's comparative perceived-value framework?*

Salient Attributes

To answer RQ1, the salient attributes of payment services were identified from the literature on banking-service quality, mobile-payment acceptance, and digital-payment functionality. Prior mobile-banking research by Chao and Dubas (2023) identified reliability, dependability, accuracy, safety, security, ease of use, timeliness, convenience, mobility, cost, and comfort as salient mobile-banking attributes, providing part of the attribute foundation for the present mobile-payment comparison.

The attributes capture several theoretically meaningful dimensions of consumer evaluation: convenience/mobility, operational reliability and risk protection, financial-credit value, and ecosystem/institutional fit. Several authors identified quality dimensions such as security, reliability, dependability, safety, and accuracy, as well as functionalities such as ease of use, ease of carrying the payment instrument, timely management of banking activities, free checking, convenience, and user comfort. For this study, seventeen paired questions were developed to measure respondents' preferences for mobile payment and card payment on these attributes. A 5-point Likert scale was used for this purpose. The scale ranged from 5 = strongly

preferred, 4 = preferred, 3 = neutral, 2 = not preferred, and 1 = least preferred. NA = not applicable.

For theoretical clarity, payment preference is conceptualized as the outcome construct in the comparative perceived-value framework. The seventeen survey attributes are interpreted primarily as indicators of three measured predictor domains: convenience/mobility, operational reliability and risk protection, and financial-credit value. Convenience/mobility captures the ability to carry and use the payment system easily across everyday settings. Operational reliability and risk protection captures payment accuracy, safe transactions, privacy protection, suspicious-transaction warnings, large-transaction alerts, malware or malfunction support, and dispute resolution. Financial-credit value captures account-opening bonuses, referral bonuses, deposit interest, purchase credit, low-interest loans, low-interest credit balances, and low-fee transactions. Ecosystem/institutional fit is developed as the broader contextual predictor construct that helps explain how payment infrastructure, platform integration, merchant acceptance, and regulation shape comparative payment preference.

The seventeen survey attributes are listed below.

1. Bonus for opening an account — Financial/Credit Value.
2. Free or low-fee transactions — Financial/Credit Value.
3. Credit for purchases — Financial/Credit Value.
4. Interest on deposited balance — Financial/Credit Value.
5. Warning of suspicious transactions — Operational Reliability/Risk Protection.
6. Low-interest borrowing — Financial/Credit Value.
7. Bonus for referring a friend — Financial/Credit Value.
8. Easy transfer or balance combination — Convenience/Mobility.
9. Large-transaction alerts — Operational Reliability/Risk Protection.
10. Low interest on credit balance — Financial/Credit Value.
11. Safe to carry and make payments — Convenience/Mobility.
12. Malware or malfunction correction — Operational Reliability/Risk Protection.
13. Protection of private information — Operational Reliability/Risk Protection.
14. Convenient way to make payments — Convenience/Mobility.
15. Safe payment transactions — Operational Reliability/Risk Protection.
16. Accurate payment transactions — Operational Reliability/Risk Protection.
17. Friendly service for disputes — Operational Reliability/Risk Protection.

Compare Salient Attributes of Mobile Payments and Card Payments

To answer RQ2, tests of hypotheses were performed to compare both modes of payment.

Hypotheses

Let X and Y represent the vectors of mean preference ratings for the seventeen attributes of mobile payments and card payments, respectively. Let $Z = X - Y$. The following hypotheses align the statistical tests with the study's paired-comparison and classification analyses.

MV hypothesis (Hotelling's T^2): The null hypothesis is that the vector of mean preference ratings for mobile payments does not differ from the vector for card

payments, $\mu_X = \mu_Y$ and $\mu_Z = 0$, where $Z = X - Y$. The alternative hypothesis is that the two vectors differ, $\mu_X \neq \mu_Y$ and $\mu_Z \neq 0$.

Paired attribute-level hypotheses (paired t-tests): For each of the seventeen salient attributes, the null hypothesis is that the mobile-minus-card mean difference equals zero; the alternative hypothesis is that the mobile-minus-card mean difference differs from zero.

Attribute-level classification hypotheses (logistic regression): For each of the seventeen standardized attribute predictors, the null hypothesis is that the odds ratio equals 1; the alternative hypothesis is that the odds ratio differs from 1.

Construct-level classification hypotheses (construct-level logistic regression): For each of the three measured construct composites, the null hypothesis is that the odds ratio equals 1; the alternative hypothesis is that the odds ratio differs from 1.

The respondents' preferences for each mode of payment (mobile payment and card payment) were measured by a 5-point Likert scale where 5 = strongly preferred, 4 = preferred, 3 = neutral, 2 = not preferred, and 1 = least preferred.

The Most Important Salient Attributes

To answer RQ3, attribute-level logistic regression, construct-level logistic regression, and random forest classification were used to identify which salient attributes and measured construct domains most strongly distinguish Chinese consumers' evaluations of mobile payments from their evaluations of traditional/card payments.

Underlying Dimensions of Salient Attributes that Differentiate between Payment Modes

To answer RQ4, factorability diagnostics followed by exploratory factor analysis were used to identify the broader dimensions that organize Chinese consumers' mobile-minus-traditional/card payment attribute differences.

METHODOLOGY

Sample Description

The survey was distributed through WeChat, a major Chinese social network and mobile communication platform. The target respondents were Chinese consumers who were reachable through this platform and who were likely to have experience with both mobile payment and card payment. One-page survey questionnaires were distributed to target respondents to obtain their evaluations of mobile-payment and card-payment attributes. A co-author clarified that the respondents were largely located in southern China, where mobile usage was described as more prevalent than PC usage. Two hundred forty survey questionnaires were distributed, of which

ninety-two completed questionnaires were returned and used for analysis in this study. The returned questionnaires represented a thirty-eight percent response rate.

The methodology uses four complementary analytical approaches aligned with the four research questions. Paired-samples comparisons address RQ2 by testing whether mean attribute ratings differ between mobile payment and traditional/card payment. Logistic regression and random forest classification address RQ3 by identifying which attributes distinguish mobile-payment observations from traditional/card-payment observations. Exploratory factor analysis addresses RQ4 by identifying broader dimensions that summarize mobile-minus-traditional/card attribute differences.

Mobile Payments versus Card Payments

The following analyses were performed to address RQ2 and RQ3. RQ2 was evaluated with Hotelling's T^2 and paired t-tests because it asks whether the same respondents rated mobile-payment and traditional/card-payment attributes differently. RQ3 was evaluated with logistic regression and random forest classification because it asks which attributes distinguish the two payment-mode evaluations.

1. Hotelling's T^2 test on the vector of mobile-minus-traditional/card attribute differences.
2. Paired t-tests for the seventeen attribute-level mobile-minus-traditional/card mean differences.
3. Logistic regression classification with payment mode as the binary outcome and the seventeen standardized attribute ratings as predictors.
4. Random forest classification as a complementary exploratory attribute-importance analysis.

For RQ3, logistic regression was estimated using a stacked classification dataset in which each respondent contributed one mobile-payment observation and one traditional/card-payment observation. Payment mode was coded as the binary outcome, and the seventeen standardized attribute ratings were used as predictors. Positive coefficients and odds ratios greater than 1 indicate stronger association with mobile-payment observations, whereas negative coefficients and odds ratios less than 1 indicate stronger association with traditional/card-payment observations. This model does not replace the paired t-tests used for RQ2; rather, it addresses the separate classification question of which attributes help distinguish the two payment modes after the attributes are considered together.

The Most Important Salient Attributes

Random forest classification was used as a complementary exploratory method for RQ3 to assess the relative importance of the seventeen salient attributes in distinguishing mobile-payment observations from traditional/card-payment observations. The analysis used the same stacked data structure as the logistic-regression model, with payment mode as the binary outcome and standardized attribute ratings as predictors. Because random forest can capture nonlinear and interaction-based patterns without imposing the additive log-odds structure of

logistic regression, it provides a nonparametric check on the relative importance of the attributes. The resulting importance rankings are therefore interpreted as evidence of relative contribution to payment-mode classification, not as coefficient estimates or formal hypothesis tests.

Fundamental Dimensions Differentiating Mobile Payments from Card Payments

To address RQ4, exploratory factor analysis was conducted on the seventeen mobile-minus-traditional/card difference scores, which capture each respondent's paired evaluation of mobile payment relative to traditional/card payment on the same salient attributes. Before estimating the factor model, the factorability of the difference-score correlation matrix was assessed using the Kaiser-Meyer-Olkin measure of sampling adequacy, Bartlett's test of sphericity, the determinant of the correlation matrix, the condition number, and individual measures of sampling adequacy. A three-factor exploratory solution was then estimated using maximum-likelihood extraction with varimax rotation. Because the analysis was exploratory and based on a modest sample, the three-factor solution was also estimated using minimum-residual extraction as a stability check, and factor congruence was examined across the two extraction methods. The resulting factors were labeled according to their substantive loadings and interpreted as exploratory dimensions of comparative payment preference.

RESULTS AND MANAGERIAL IMPLICATIONS

This section reports the empirical findings in the order of the research questions. It first describes the respondent profile and payment-use context, then presents the paired-comparison results used to evaluate differences between mobile payment and traditional/card payment. The section then reports the attribute-level and construct-level classification results for RQ3, including logistic regression, random forest analysis, and the dashboard synthesis. It concludes with the exploratory factor analysis used to identify broader dimensions underlying the mobile-minus-traditional/card attribute differences.

Table 1 presents the background information of these respondents, including gender and income.

Table 1 Background Information of the Respondents			
<i>Note. Family-income categories are reported in Chinese renminbi (RMB).</i>			
Variable	Category	n	Percent
Age	<18	2	2.2
	19–35	42	45.7
	36–50	23	25.0
	>50	25	27.2
Education	High school	15	16.3
	College	59	64.1
	Graduate	18	19.6
Family income	< RMB 35k	2	2.2
	RMB 35k–50k	5	5.4
	RMB 50k–75k	17	18.5
	> RMB 75k	68	73.9
Gender	Male	37	40.2
	Female	55	59.8
Marital status	Married	60	65.2
	Single	32	34.8

Table 2 summarizes respondents' mobile-payment account structure. Most respondents reported that their mobile payment was linked to a bank account or card, and most indicated that the mobile app either stored value or offered credit, consistent with the platform-wallet structure described in the Literature Review.

Table 2 Mobile Payments Account Structure			
Variable	Category	n	Percent
Mobile payment linked to bank account	Yes	68	73.9
	No	24	26.1
Mobile payment linked to card	Yes	81	88.0
	No	11	12.0
Mobile app stores value or offers credit	Yes	82	89.1
	No	10	10.9

Table 3 summarizes respondents' banking and payment experience. Most respondents reported substantial experience with bank accounts, credit/debit cards, and mobile payment, and monthly mobile-payment activity was especially frequent, with 70.7% reporting more than 20 mobile-payment transactions per month.

Table 3 Respondents' Banking and Payment Experiences			
Variable	Category	n	Percent
Monthly card transactions	<1	31	33.7
	1–5	13	14.1
	6–10	9	9.8
	11–20	7	7.6
	>20	32	34.8
Monthly cash/check transactions	<1	40	43.5
	1–5	19	20.7
	6–10	7	7.6
	11–20	3	3.3
	>20	23	25.0
Monthly mobile transactions	<1	16	17.4
	1–5	4	4.3
	6–10	2	2.2
	11–20	5	5.4
	>20	65	70.7
Years with bank account	<1 year	5	5.4
	1–5 years	3	3.3
	6–10 years	12	13.0
	11–20 years	17	18.5
	>20 years	55	59.8
Years using credit/debit card	<1 year	4	4.3
	1–5 years	6	6.5
	6–10 years	18	19.6
	11–20 years	14	15.2
	>20 years	50	54.3
Years using mobile payment	<1 year	12	13.0
	1–5 years	32	34.8
	6–10 years	21	22.8
	11–20 years	10	10.9
	>20 years	17	18.5

Table 4 reports respondents' banking-channel preference ratings. Mobile app/web/SMS banking received the highest mean rating, indicating that respondents favored mobile-enabled banking channels over branch, mail, phone, and public-computer alternatives.

Table 4 Banking Channel Preference Ratings			
Channel	n	Mean	SD
Mobile app/web/SMS	92	3.978	0.983
Internet using computer/tablet	92	3.272	1.140
ATM/cash machine	92	2.587	1.111
Phone/voice service	92	2.587	1.081
SMS alerts/warnings	92	2.543	1.053
Branch teller	92	2.500	1.181
Family/friend assists banking	92	2.283	0.953
Account updates by mail	92	2.283	0.869
Public computer with internet	92	2.152	0.937

Figure 2 visualizes the banking-channel preference ratings reported in Table 5, highlighting the stronger preference for mobile app/web/SMS banking compared with branch, phone, mail, and public-computer channels.

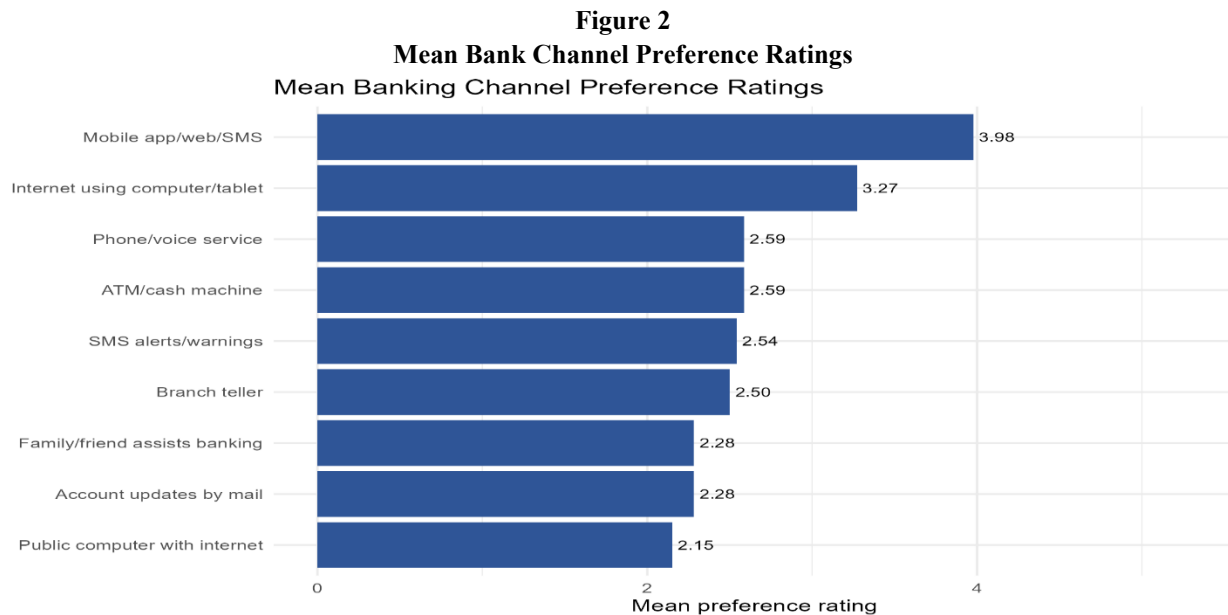


Figure 3 provides a visual comparison of mean attribute ratings by payment mode, complementing Table 5 by showing where mobile and traditional/card payment ratings appear most similar or different before formal paired testing.

Figure 3
Mean Attribute Ratings by Payment Mode
Mean Attribute Ratings by Payment Mode

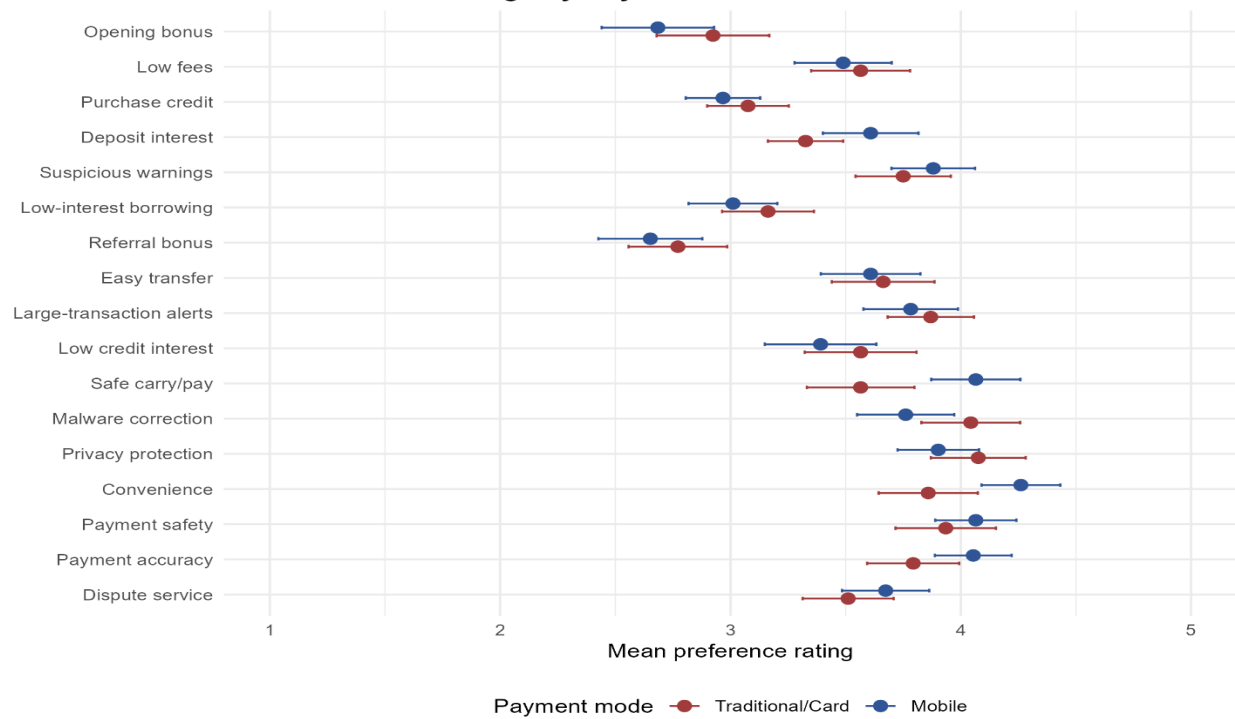


Table 5
Summary Statistics of Seventeen Attributes by Payment Mode

Note. Mean difference is calculated as mobile mean – traditional/card mean.

Attribute	Construct	Mobile Mean	Mobile SD	Traditional/ Card Mean	Traditional/ Card SD	Mean Difference
Bonus for opening an account	Financial/Credit Value	2.685	1.195	2.924	1.197	-0.239
Free or low-fee transactions	Financial/Credit Value	3.489	1.032	3.565	1.051	-0.076
Credit for purchases	Financial/Credit Value	2.967	0.791	3.076	0.867	-0.109
Interest on deposited balance	Financial/Credit Value	3.609	1.016	3.326	0.800	0.283
Warning of suspicious transactions	Operational Reliability/ Risk Protection	3.880	0.888	3.750	1.012	0.130
Low-interest borrowing	Financial/Credit Value	3.011	0.943	3.163	0.975	-0.152
Bonus for referring a friend	Financial/Credit Value	2.652	1.104	2.772	1.049	-0.120
Easy transfer or balance combination	Convenience/ Mobility	3.609	1.058	3.663	1.092	-0.054
Large-transaction alerts	Operational Reliability/ Risk Protection	3.783	1.004	3.870	0.916	-0.087
Low interest on credit balance	Financial/Credit Value	3.391	1.186	3.565	1.189	-0.174
Safe to carry and make payments	Convenience/ Mobility	4.065	0.947	3.565	1.142	0.500
Malware or malfunction correction	Operational Reliability/ Risk Protection	3.761	1.031	4.043	1.047	-0.283
Protection of private information	Operational Reliability/ Risk Protection	3.902	0.865	4.076	1.008	-0.174
Convenient way to make payments	Convenience/ Mobility	4.261	0.837	3.859	1.054	0.402
Safe payment transactions	Operational Reliability/ Risk Protection	4.065	0.862	3.935	1.067	0.130
Accurate payment transactions	Operational Reliability/ Risk Protection	4.054	0.817	3.793	0.978	0.261
Friendly service for disputes	Operational Reliability/ Risk Protection	3.674	0.927	3.511	0.966	0.163

Multivariate Hotelling's T^2 Test

This study utilized the open-source R statistical software for data analysis. The preference ratings of ninety-two respondents were averaged for each of the seventeen salient attributes to form a mean rating vector for mobile payments (X) and a mean rating vector for traditional/card payments (Y). The vector of mean differences is $Z = X - Y$. In the following, Z is represented by the mobile-minus-traditional/card attribute-difference vector.

Because the same respondents evaluated both payment modes, a paired multivariate Hotelling's T^2 test was used to compare the vector of mobile-minus-traditional/card attribute differences with a zero vector. The test was conducted in R using standard Hotelling's T^2 procedures; earlier Rmd output also checked the result with the ICSNP and DescTools packages. The substantive result is summarized in Table 6, so the underlying R code and console output are not reported in the manuscript.

Hotelling's T^2 test rejects the null hypothesis and concludes that there is a statistically significant difference between the mean vectors of attribute ratings for mobile payments and card payments.

Table 6						
Hotelling's T ² Test of Mobile-minus-Traditional/Card Attribute Differences						
Test	Respondents complete	Attributes	T ²	df1	df2	p
Hotelling's one-sample T-squared test	92	17	3.669	17	75	< .001
Note. The test evaluates whether the vector of mobile-minus-traditional/card mean differences across the 17 attributes differs from zero.						

Paired t-tests

To address RQ2, the study first used Hotelling's T^2 test to evaluate whether the vector of mobile-minus-traditional/card attribute differences across all seventeen attributes differed from zero. The significant Hotelling's T^2 result indicates that Chinese respondents did not evaluate mobile payments and traditional/card payments identically across the full set of salient attributes. This multivariate result provides overall evidence of differences between the two payment modes and justifies examining the attribute-level paired t-tests.

The paired t-tests identify which specific attributes differ significantly between mobile payment and traditional/card payment ratings. Five of the seventeen attributes show statistically significant paired mean differences at the 5% level. Because mean difference is calculated as mobile mean minus traditional/card mean, positive values indicate higher ratings for mobile payment, whereas negative values indicate higher ratings for traditional/card payment.

The significant paired results show a mixed but theoretically meaningful pattern. Traditional/card payment is rated significantly higher for *bonus for opening an account*, indicating that established card or conventional payment systems retain an advantage on this financial-credit incentive. Mobile payment is rated significantly higher for *interest on deposited*

balance, safe to carry and make payments, convenient way to make payments, and accurate payment transactions. These findings suggest that mobile payments are especially strong on convenience/mobility, operational reliability and risk protection, and selected financial-credit value dimensions, while traditional/card payments retain at least one advantage in account-opening incentives.

The following five hypotheses are supported by the paired t-tests, but the direction of the effect differs across attributes:

H1. Bonus for opening an account — traditional/card payment rated higher.

H4. Interest on deposited balance — mobile payment rated higher.

H11. Safe to carry and make payments — mobile payment rated higher.

H14. Convenient way to make payments — mobile payment rated higher.

H16. Accurate payment transactions — mobile payment rated higher.

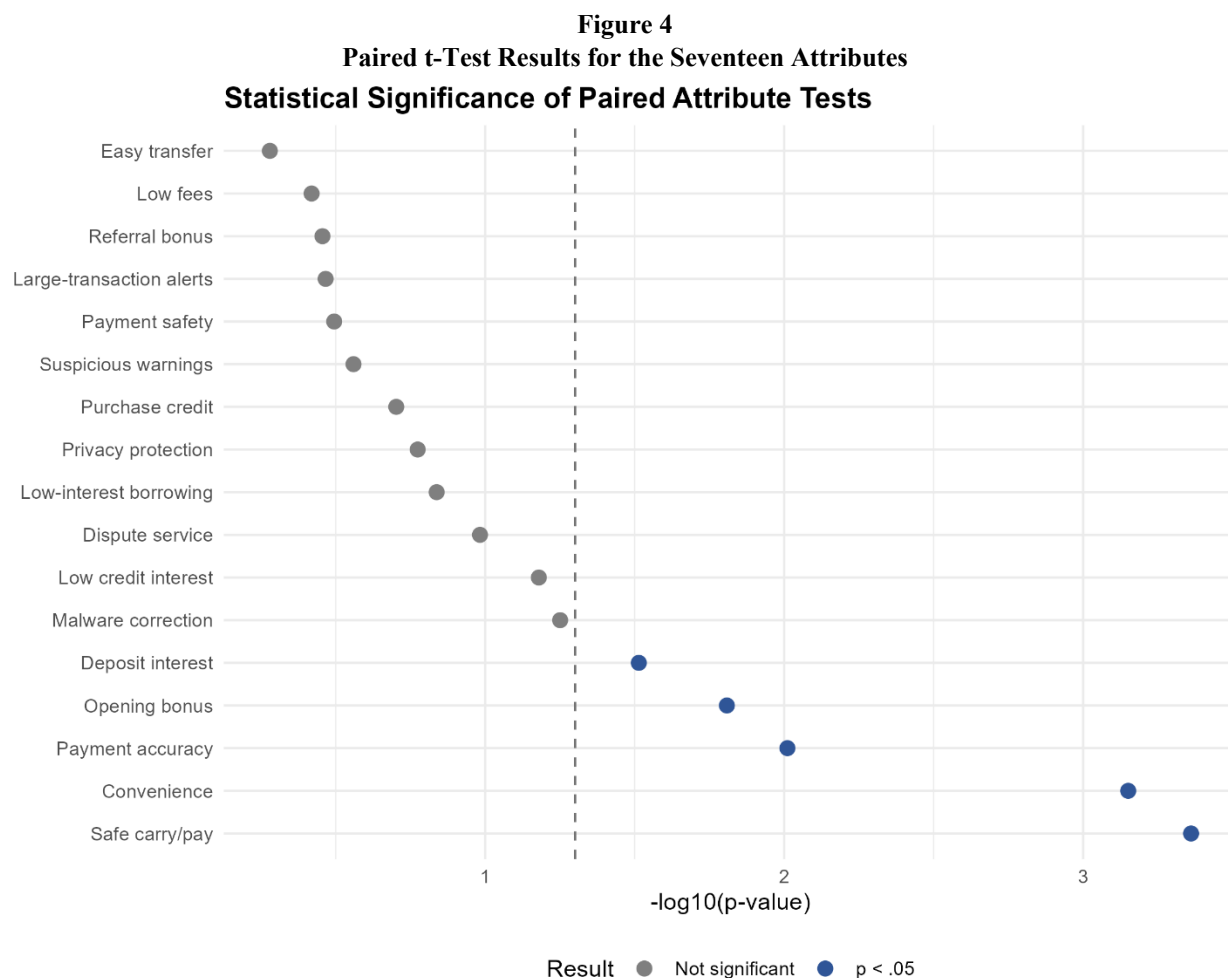
Table 7 Two-Tailed Paired t-Tests: Ratings of Mobile versus Traditional/Card Payments <i>n = 92, df = 91. H0: mean difference = 0; mean difference = mobile mean – traditional/card mean.</i>						
Attribute	Construct	Mean diff.	t	p	Cohen dz	Decision and direction
Bonus for opening an account	Financial/Credit Value	-0.239	-2.466	0.016	-0.257	Reject H0; traditional/card rated higher
Free or low-fee transactions	Financial/Credit Value	-0.076	-0.881	0.381	-0.092	Fail to reject H0; no significant difference
Credit for purchases	Financial/Credit Value	-0.109	-1.296	0.198	-0.135	Fail to reject H0; no significant difference
Interest on deposited balance	Financial/Credit Value	0.283	2.196	0.031	0.229	Reject H0; mobile rated higher
Warning of suspicious transactions	Operational Reliability/Risk Protection	0.130	1.097	0.276	0.114	Fail to reject H0; no significant difference
Low-interest borrowing	Financial/Credit Value	-0.152	-1.469	0.145	-0.153	Fail to reject H0; no significant difference
Bonus for referring a friend	Financial/Credit Value	-0.120	-0.939	0.350	-0.098	Fail to reject H0; no significant difference
Easy transfer or balance combination	Convenience/Mobility	-0.054	-0.638	0.525	-0.067	Fail to reject H0; no significant difference
Large-transaction alerts	Operational Reliability/Risk Protection	-0.087	-0.956	0.342	-0.100	Fail to reject H0; no significant difference
Low interest on credit balance	Financial/Credit Value	-0.174	-1.860	0.066	-0.194	Fail to reject H0; no significant difference
Safe to carry and make payments	Convenience/Mobility	0.500	3.651	<.001	0.381	Reject H0; mobile rated higher
Malware or malfunction correction	Operational Reliability/Risk Protection	-0.283	-1.935	0.056	-0.202	Fail to reject H0; no significant difference
Protection of private information	Operational Reliability/Risk Protection	-0.174	-1.389	0.168	-0.145	Fail to reject H0; no significant difference
Convenient way to make payments	Convenience/Mobility	0.402	3.507	<.001	0.366	Reject H0; mobile rated higher
Safe payment transactions	Operational Reliability/Risk Protection	0.130	1.000	0.320	0.104	Fail to reject H0; no significant difference
Accurate payment transactions	Operational Reliability/Risk Protection	0.261	2.640	0.010	0.275	Reject H0; mobile rated higher
Friendly service for disputes	Operational Reliability/Risk Protection	0.163	1.642	0.104	0.171	Fail to reject H0; no significant difference

A negative t-value for an attribute indicates that its average rating was higher for card payment than for mobile payment. A positive t-value for an attribute indicates that its average rating was higher for mobile payment than card payment. Cohen's dz is the paired-samples effect size, expressing the mean paired difference in standard-deviation units; values closer to zero indicate smaller practical differences.

The five supported paired-comparison hypotheses indicate that Chinese respondents differentiated mobile payment and traditional/card payment on a limited but theoretically meaningful set of attributes. Four supported hypotheses favored mobile payment: interest on

deposited balance, safe to carry and make payments, convenient way to make payments, and accurate payment transactions. These attributes suggest that mobile payment creates comparative perceived value in this sample primarily through convenience/mobility, operational reliability and risk protection, and selected financial-credit value features. One supported hypothesis favored traditional/card payment: bonus for opening an account. This result suggests that established banks and card issuers may retain an advantage on account-opening promotions and related financial-credit incentives.

The remaining twelve attribute-level hypotheses were not supported at the 5% level. These nonsignificant results indicate that respondents did not rate mobile payment and traditional/card payment differently on several financial-credit, operational-reliability/risk-protection, transfer/service, and transaction-fee attributes. Rather than implying that these attributes are unimportant, the results suggest perceived parity between the two payment modes on those dimensions within this sample.



This parity pattern has practical and theoretical significance. Although mobile payments became widespread relatively recently, respondents evaluated them similarly to established traditional/card payment systems on many attributes related to financial-credit value, operational reliability and risk protection, transfer capability, and service support. The findings suggest that mobile payments do not need to outperform traditional/card payments on every attribute to become preferred. Instead, strong advantages in convenience/mobility and operational reliability, including payment accuracy, may compensate for areas where traditional/card payment remains competitive. For banks, card issuers, and mobile-payment providers, the results point to the importance of strengthening mobile-payment infrastructure while also recognizing which card-payment advantages remain meaningful to consumers.

The nonsignificant result for free or low-fee transactions should also be interpreted in context. Consumers may not directly observe payment-processing fees because these costs are typically borne by merchants and financial intermediaries rather than by consumers at the point of sale. Thus, the absence of a significant paired difference on transaction fees does not imply that fee structures are irrelevant; rather, it suggests that their effects may operate indirectly through merchant acceptance and payment availability.

Logistic Regression Analysis

To begin addressing RQ3, logistic regression was estimated with payment mode as the binary outcome variable, coded 1 for mobile payment and 0 for card payment. The seventeen salient attribute ratings were used as explanatory variables. Positive coefficients indicate attributes associated more strongly with mobile payment, whereas negative coefficients indicate attributes associated more strongly with card payment. Statistically significant coefficients identify attributes that distinguish the two payment modes after accounting for the other attributes in the model.

The model was estimated in R using a stacked dataset in which each respondent contributed one mobile-payment observation and one traditional/card-payment observation. Payment mode was coded as 1 for mobile payment and 0 for traditional/card payment. The seventeen standardized attribute ratings served as predictors. Odds ratios above 1 indicate stronger association with mobile-payment observations, whereas odds ratios below 1 indicate stronger association with traditional/card-payment observations.

For each attribute, the logistic-regression null hypothesis is that the coefficient equals zero, or equivalently that the odds ratio equals 1. The alternative hypothesis is that the attribute significantly distinguishes mobile-payment observations from traditional/card-payment observations. Attributes with odds ratios greater than 1 and $p < .05$ are interpreted as significantly associated with mobile payment; attributes with odds ratios less than 1 and $p < .05$ are interpreted as significantly associated with traditional/card payment; and attributes with $p \geq .05$ are interpreted as not statistically distinguishing the two payment modes.

The logistic-regression results show which attributes most clearly distinguish mobile-payment observations from traditional/card-payment observations after the seventeen standardized attribute ratings are considered together. The model-fit statistics in Table 8 indicate

that the attribute predictors improve classification relative to the intercept-only model. Table 9 then identifies the attribute-level associations. Odds ratios greater than 1 indicate stronger association with mobile-payment observations, while odds ratios less than 1 indicate stronger association with traditional/card-payment observations. Three attributes are significantly associated with mobile-payment classification: safe to carry and make payments, convenient way to make payments, and friendly service for disputes. Three attributes are significantly associated with traditional/card-payment classification: malware or malfunction correction, low interest on credit balance, and safe payment transactions. The remaining attributes do not significantly distinguish the two payment modes in the multivariable logistic model. These findings complement the paired t-tests by showing not only where mean ratings differ, but also which standardized attributes are most useful for classifying payment-mode evaluations.

Table 8 summarizes the fit of the logistic-regression classification model used for RQ3. The model compares a baseline intercept-only model with a model that uses the seventeen standardized payment-attribute ratings to distinguish mobile-payment observations from traditional/card-payment observations. The reduction from the null deviance of 255.078 to the residual deviance of 189.085 indicates that the attribute predictors improve classification relative to the null model. The log likelihood, AIC, and BIC provide additional model-fit information for documenting the estimated model and for comparison with alternative specifications if needed.

Table 8 Logistic Regression Model Fit Statistics <i>Model predicting mobile versus traditional/card payment classification.</i>	
Statistic	Value
Null deviance	255.078
Null df	183
Likelihood-ratio χ^2	65.993, df = 17, p < .001
Log likelihood	-94.542
McFadden pseudo-R ²	0.259
AIC	225.085
BIC	282.953
Residual deviance	189.085
Residual df	166
Observations	184

The number of observations is 184 because the logistic-regression data are arranged in a stacked classification format. The original sample contains 92 respondents, and each respondent provided ratings for both payment modes: one set of ratings for mobile payment and one set of ratings for traditional/card payment. Thus, each respondent contributes two payment-mode observations to the classification dataset, yielding $92 \times 2 = 184$ observations. This stacked structure is appropriate for RQ3 because the analysis asks which attributes distinguish mobile-payment evaluations from traditional/card-payment evaluations, whereas the paired t-tests in Table 7 use the original respondent-level paired-difference structure to test mean differences.

The logistic regression results in Table 9 indicate that several attributes significantly distinguished mobile payment from card payment. Positive and significant coefficients were found for safe to carry and make payments, payment convenience, and friendly dispute service,

suggesting that these attributes favored mobile payment in the classification model. Negative and significant coefficients were found for low interest on credit balance, malware or malfunction correction, and safe payment transactions, suggesting that these attributes favored card payment. These findings show that Chinese consumers' evaluations were not differentiated by a single broad factor; instead, payment-mode distinction reflected a combination of convenience/mobility, operational reliability and risk protection, service support, and financial-credit value.

As a secondary construct-level check, the seventeen standardized attribute ratings were averaged into three theory-based composite indices: convenience/mobility, operational reliability and risk protection, and financial-credit value. Reliability diagnostics generally supported using these composites as exploratory construct indices. Cronbach's alpha values were .528 for mobile convenience/mobility and .730 for traditional/card convenience/mobility, .758 and .881 for operational reliability and risk protection, and .743 and .811 for financial-credit value, respectively. The construct-level logistic regression results in Table 10 showed that convenience/mobility was positively associated with mobile-payment classification, whereas operational reliability and risk protection and financial-credit value were negatively associated with mobile-payment classification, indicating stronger association with traditional/card payment observations. Because the mobile convenience/mobility alpha was modest and because the composites are theory-based rather than validated scales, these results should be interpreted as exploratory construct-level evidence rather than as validation of latent scales.

Table 9 Logistic Regression Payment Mode Logistic Regression Odds-Ratio Results by Attribute <i>Odds ratios > 1 indicate stronger association with mobile-payment observations; odds ratios < 1 indicate stronger association with traditional/card-payment observations. Significance is reported at $p < .05$.</i>						
Attribute	Construct	Odds Ratio	95% CI	z	p	Attribute association
<i>Safe to carry and make payments</i>	<i>Convenience/Mobility</i>	3.928	2.11–8.11	3.994	< .001	Significant mobile association
<i>Convenient way to make payments</i>	<i>Convenience/Mobility</i>	3.631	1.63–9.04	2.999	0.003	Significant mobile association
<i>Friendly service for disputes</i>	<i>Operational Reliability/Risk Protection</i>	2.226	1.20–4.36	2.458	0.014	Significant mobile association
Accurate payment transactions	Operational Reliability/Risk Protection	1.555	0.62–4.04	0.940	0.347	Not significant
Interest on deposited balance	Financial/Credit Value	1.407	0.74–2.74	1.025	0.305	Not significant
Warning of suspicious transactions	Operational Reliability/Risk Protection	1.150	0.65–2.11	0.468	0.640	Not significant
Large-transaction alerts	Operational Reliability/Risk Protection	1.058	0.45–2.55	0.129	0.897	Not significant
Easy transfer or balance combination	Convenience/Mobility	1.046	0.57–1.92	0.145	0.885	Not significant
Credit for purchases	Financial/Credit Value	0.976	0.41–2.36	-0.055	0.956	Not significant
Bonus for opening an account	Financial/Credit Value	0.937	0.61–1.42	-0.310	0.757	Not significant
Bonus for referring a friend	Financial/Credit Value	0.898	0.52–1.57	-0.380	0.704	Not significant
Low-interest borrowing	Financial/Credit Value	0.858	0.43–1.69	-0.439	0.661	Not significant
Protection of private information	Operational Reliability/Risk Protection	0.626	0.27–1.37	-1.148	0.251	Not significant
Free or low-fee transactions	Financial/Credit Value	0.615	0.33–1.13	-1.561	0.118	Not significant
<i>Malware or malfunction correction</i>	<i>Operational Reliability/Risk Protection</i>	0.476	0.25–0.86	-2.350	0.019	Significant traditional/card association
<i>Low interest on credit balance</i>	<i>Financial/Credit Value</i>	0.408	0.19–0.82	-2.426	0.015	Significant traditional/card association
<i>Safe payment transactions</i>	<i>Operational Reliability/Risk Protection</i>	0.272	0.09–0.76	-2.414	0.016	Significant traditional/card association

Figure 5
Logistic Regression Odds Ratios by Attribute
Odds Ratios Predicting Mobile-Payment Classification
 Odds ratios greater than 1 indicate stronger association with mobile-payment observations

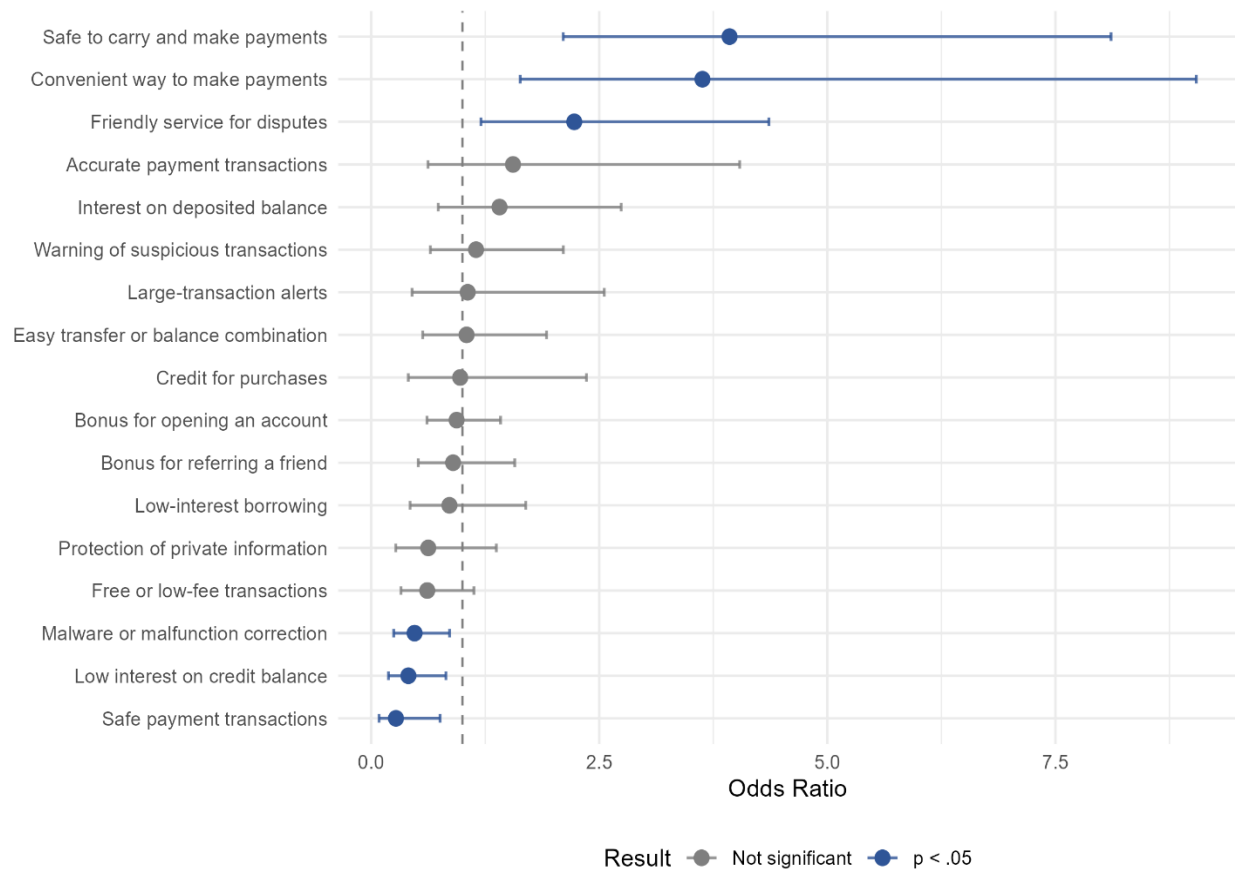


Table 10
Secondary Construct-Level Logistic Regression Results
 McFadden pseudo- $R^2 = 0.0586$; LR $\chi^2 = 15.00$, $p = .002$

Construct	Coefficient	Odds Ratio	95% CI	z	p	Association
<i>Convenience/Mobility</i>	0.866	2.376	1.494–3.946	3.51	< .001	Mobile
<i>Operational Reliability/Risk Protection</i>	−0.464	0.629	0.405–0.954	−2.13	.033	Traditional/Card
<i>Financial/Credit Value</i>	−0.398	0.672	0.471–0.942	−2.26	.024	Traditional/Card

Note. Coefficients are log-odds coefficients and equal the natural logarithms of the reported odds ratios. The model uses standardized theory-based construct composite indices. Odds ratios greater than 1 indicate stronger association with mobile-payment observations; odds ratios less than 1 indicate stronger association with traditional/card-payment observations. The construct indices are exploratory composites rather than validated latent scales.

Equation (3) formalizes the construct-level logistic regression as an exploratory classification implementation of the measured portion of the comparative perceived-value framework. It operationalizes three measured predictor domains from Equation (1) within the mobile-versus-traditional/card classification structure implied by Equation (2).

$$\ln(P(\text{Mobile})/[1 - P(\text{Mobile})]) = 0.001 + 0.866\text{CM}_z - 0.464\text{ORP}_z - 0.398\text{FCV}_z + e \quad \text{q. (3)}$$

Equation (3) reports the same construct-level model as Table 10 on the log-odds scale. The coefficient column in Table 10 is obtained by taking the natural logarithm of each odds ratio: $\ln(2.376) = 0.866$, $\ln(0.629) = -0.464$, and $\ln(0.672) = -0.398$. Thus, holding the other construct composites constant, a one-standard-deviation increase in CM_z increases the log-odds of mobile-payment classification, whereas one-standard-deviation increases in ORP_z and FCV_z decrease the log-odds and correspond to stronger traditional/card-payment association.

Substantively, the Table 10 pattern suggests that mobile payment is distinguished most clearly by convenience and mobility, whereas traditional/card payment retains comparatively stronger associations with reliability/risk-protection and financial-credit value features.

The intercept is included in Equation (3), but the table reports only the construct predictors because the substantive interpretation focuses on their odds ratios. The construct-level model showed modest explanatory strength, with McFadden pseudo- $R^2 = 0.0586$, but the likelihood-ratio test indicated that the three construct composites jointly improved fit relative to the intercept-only model, $\text{LR } \chi^2(3) = 15.00$, $p = .002$. Therefore, the construct-level logistic regression should be interpreted as a parsimonious exploratory directional check rather than as a strong predictive model.

Because logistic regression models additive linear effects on the log-odds of payment mode, random forest classification was used as a complementary nonparametric analysis for RQ3. The random forest model ranks the relative importance of the seventeen attributes in distinguishing mobile-payment observations from traditional/card-payment observations and can capture nonlinear or interaction-based patterns that may not be emphasized in the logistic-regression model.

Random Forest Analysis

To complement the logistic-regression results, a random forest classification model was estimated with the same stacked dataset of 184 observations: 92 traditional/card observations and 92 mobile-payment observations. No observations were removed for missing values. The model correctly classified 63 of 92 traditional/card observations and 57 of 92 mobile-payment observations. Out-of-bag accuracy and balanced accuracy were both .652 because the outcome classes were evenly balanced. Cohen's kappa was .304, indicating classification performance above chance but moderate rather than strong. Sensitivity for mobile payment was .620, and specificity for traditional/card payment was .685. Thus, the random forest is best interpreted as a

complementary nonparametric attribute-importance analysis for RQ3 rather than as a definitive predictive model.

Table 11		
Random Forest Out-of-Bag Confusion Matrix		
Predicted class	Observed Traditional/Card	Observed Mobile
Traditional/Card	63	35
Mobile	29	57

Note. Diagonal cells show correct out-of-bag classifications; off-diagonal cells show misclassifications. Traditional/Card is the reference class and Mobile is the target or positive class.

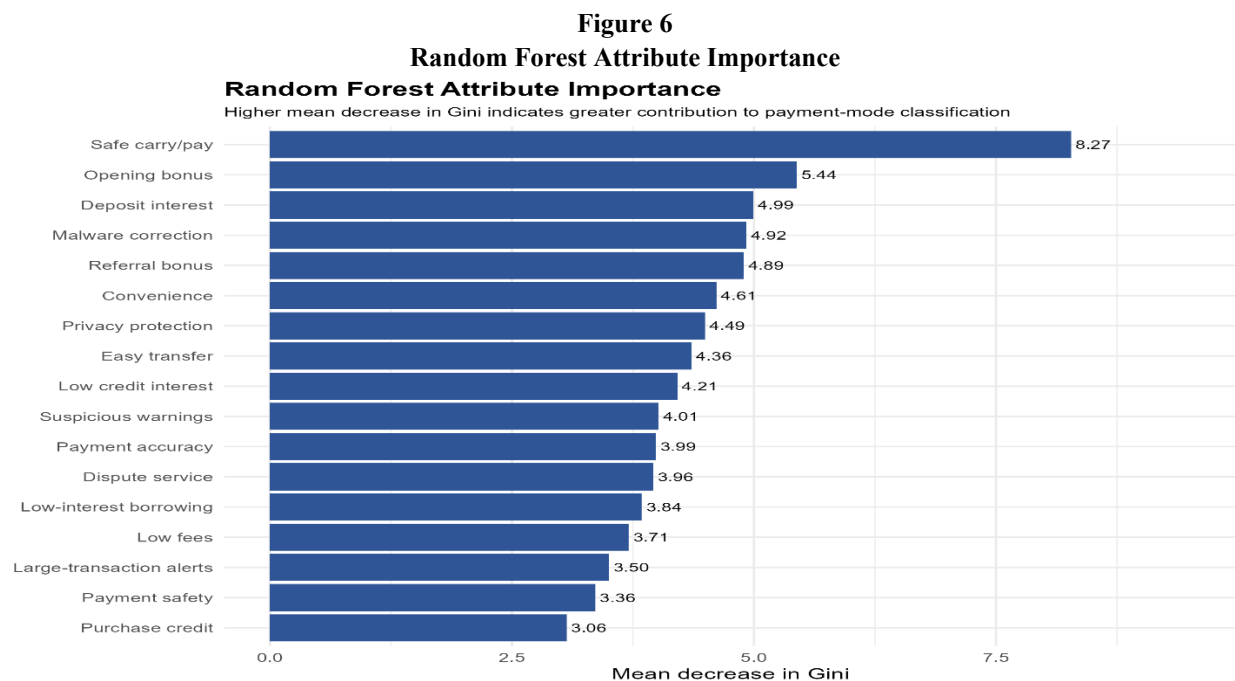
Table 12	
Random Forest Classification Performance	
Statistic	Value
Reference class	Traditional/Card
Target/positive class	Mobile
Complete-case observations	184
Outcome classes	2
Number of trees	1,000
Out-of-bag accuracy	0.652
Out-of-bag error	0.348
Cohen's kappa	0.304
Sensitivity for Mobile	0.620
Specificity for Traditional/Card	0.685
Balanced accuracy	0.652

Note. Traditional/Card is the reference class and Mobile is the target or positive class. Metrics are based on out-of-bag predictions from the random forest. Cohen's kappa adjusts accuracy for chance agreement.

Together, Tables 11 and 12 indicate that the random forest provides moderate classification performance, supporting its use as a supplementary importance-ranking tool rather than as a definitive predictive model.

Table 13 Random Forest Attribute Importance for Classifying Mobile vs. Traditional/Card Payment Observations <i>Attributes are ranked by mean decrease in Gini. Higher values indicate greater contribution to payment-mode classification. Random forest importance is interpreted as a complementary nonparametric importance ranking rather than a coefficient significance test.</i>				
Rank	Attribute	Construct	Mean decrease Gini	Mean decrease accuracy
1	Safe to carry and make payments	Convenience/Mobility	8.27	31.04
2	Bonus for opening an account	Financial/Credit Value	5.44	9.31
3	Interest on deposited balance	Financial/Credit Value	4.99	15.76
4	Malware or malfunction correction	Operational Reliability/Risk Protection	4.92	11.42
5	Bonus for referring a friend	Financial/Credit Value	4.89	14.05
6	Convenient way to make payments	Convenience/Mobility	4.61	14.55
7	Protection of private information	Operational Reliability/Risk Protection	4.49	15.72
8	Easy transfer or balance combination	Convenience/Mobility	4.36	9.90
9	Low interest on credit balance	Financial/Credit Value	4.21	10.30
10	Warning of suspicious transactions	Operational Reliability/Risk Protection	4.01	6.52
11	Accurate payment transactions	Operational Reliability/Risk Protection	3.99	14.65
12	Friendly service for disputes	Operational Reliability/Risk Protection	3.96	10.64
13	Low-interest borrowing	Financial/Credit Value	3.84	5.37
14	Free or low-fee transactions	Financial/Credit Value	3.71	7.80
15	Large-transaction alerts	Operational Reliability/Risk Protection	3.50	7.91
16	Safe payment transactions	Operational Reliability/Risk Protection	3.36	9.68
17	Credit for purchases	Financial/Credit Value	3.06	6.18

Mean decrease in Gini indicates how much an attribute contributes to creating purer classification splits across the random forest; larger values indicate greater contribution to separating mobile-payment observations from traditional/card-payment observations. Mean decrease in accuracy indicates how much out-of-bag classification accuracy declines when an attribute is permuted; larger values indicate greater model dependence on that attribute for accurate classification.



The attribute-importance results in Table 13 and Figure 6 reinforce the role of convenience and mobility in distinguishing payment-mode evaluations. The highest-ranked attribute is safe to carry and make payments, which also appears as a significant mobile-associated attribute in the logistic-regression results. Payment convenience is also highly ranked, again converging with the logistic-regression evidence. At the same time, the random forest highlights several financial-credit and operational-reliability/risk-protection attributes, including bonus for opening an account, interest on deposited balance, malware or malfunction correction, bonus for referring a friend, privacy protection, and low interest on credit balance. This pattern suggests that consumers' payment-mode evaluations are not driven by a single attribute but by a combination of convenience, financial value, and operational-reliability or protection-related considerations. Because random forest importance is not a coefficient significance test, these rankings should be interpreted as complementary evidence about relative classification importance rather than as replacements for the paired t-tests or logistic-regression odds ratios.

Taken together, the RQ3 evidence shows that the attributes distinguishing mobile-payment and traditional/card-payment evaluations are concentrated in convenience/mobility, selected operational-reliability/risk-protection features, and financial-credit value. The paired t-tests show that mobile payment is rated significantly higher for safe to carry and make payments, convenience, payment accuracy, and interest on deposited balances, while traditional/card payment retains an advantage for account-opening bonuses. Logistic regression further identifies safe to carry and make payments, payment convenience, and friendly dispute service as significant mobile-associated attributes, while safe payment transactions, malware or malfunction correction, and low interest on credit balance are significant traditional/card-

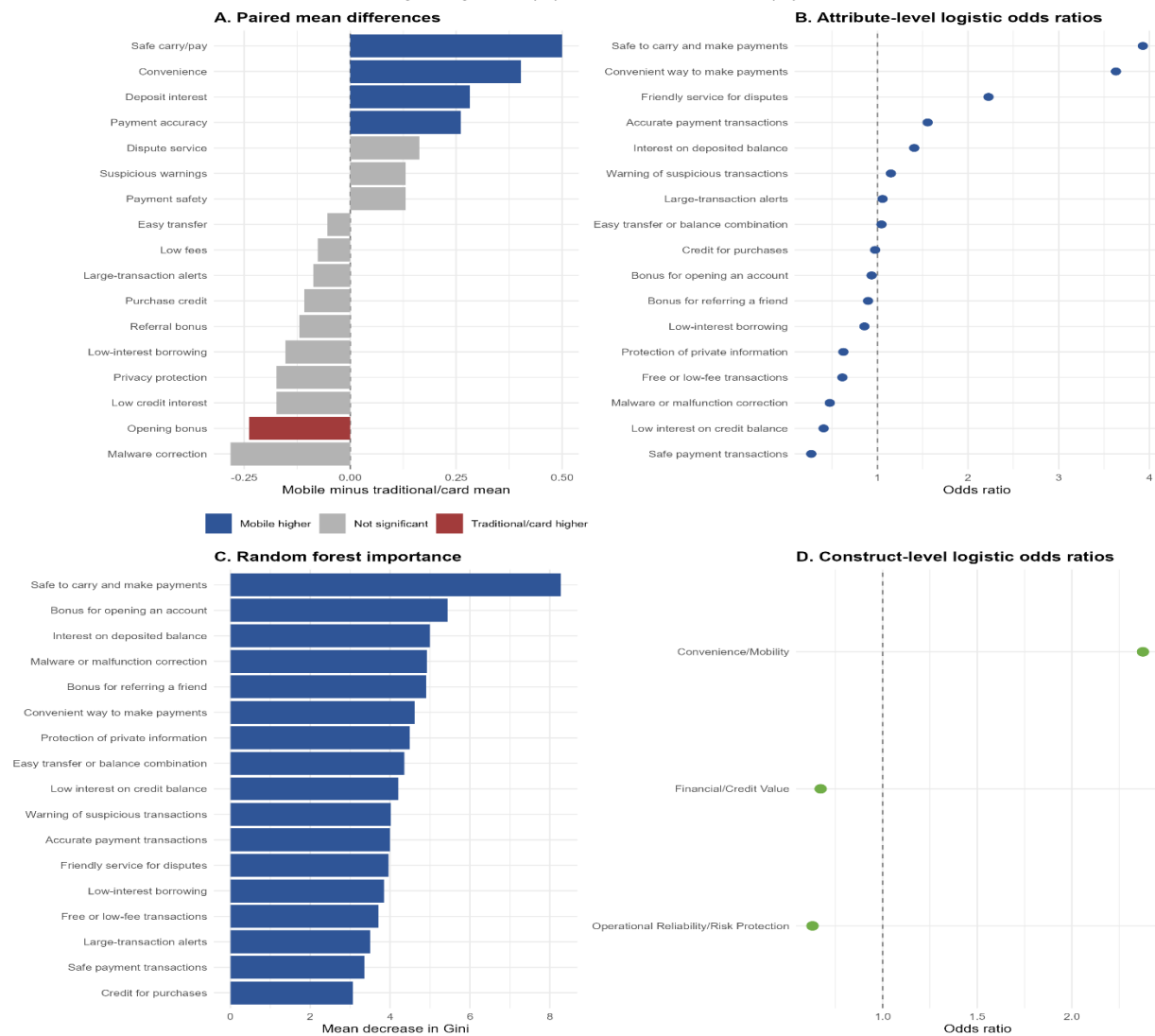
associated attributes. The random forest results complement these findings by ranking safe to carry and make payments as the strongest classifier and by showing that financial incentives, deposit interest, malware correction, payment convenience, privacy protection, and low credit interest also contribute to payment-mode classification. Overall, RQ3 indicates that Chinese consumers' payment-mode evaluations are shaped by a combination of convenience/mobility, operational reliability and risk protection, and financial-credit value rather than by a single dominant factor.

Figure 7 summarizes the main empirical evidence across paired mean differences, attribute-level logistic odds ratios, random-forest importance rankings, and construct-level logistic odds ratios. The dashboard shows that convenience/mobility provides the clearest mobile-payment advantage, while selected financial-credit and operational-reliability/risk-protection attributes continue to differentiate traditional/card payment. Together, the panels provide a compact visual synthesis of the attribute-level and construct-level evidence used to address RQ3.

Figure 7. Dashboard of Attribute-Level and Construct-Level Evidence Distinguishing Mobile Payment from Traditional/Card Payment

Dashboard of Main Findings

Attribute-level and construct-level evidence distinguishing mobile payment from traditional/card payment



Exploratory Factor Analysis for RQ4

The exploratory factor analysis was conducted to identify broader dimensions underlying the seventeen mobile-minus-traditional/card difference scores. These scores represent each respondent's comparative evaluation of mobile payment relative to traditional/card payment for the same salient attribute. Consistent with the exploratory purpose of RQ4, the analysis was used to examine whether the paired attribute differences organized into interpretable comparative-value dimensions rather than to estimate a confirmatory measurement model.

Before estimating the exploratory factor model, the factorability of the difference-score correlation matrix was assessed using standard factor-analytic diagnostics (Hair et al., 2018). The

analysis used complete data from 92 respondents across 17 paired payment attributes, with no missing values. The overall Kaiser-Meyer-Olkin measure of sampling adequacy was .692, indicating that the matrix was usable for exploratory factor analysis, although the result should be interpreted cautiously given the modest sample size. Bartlett's test of sphericity was significant, $\chi^2(136) = 824.719$, $p < .001$, indicating that the correlation matrix differed from an identity matrix and contained sufficient patterned associations for factor analysis. The determinant of the correlation matrix was 5.77×10^{-5} , and the condition number was 48.951, suggesting strong inter-item relationships but not preventing exploratory analysis.

Individual MSA values were generally acceptable for the safety, convenience, privacy, accuracy, and dispute-service attributes. One item, large-transaction alerts, had an individual MSA below .50. Because RQ4 concerns the full set of seventeen paired attributes and because the three-factor solution was substantively stable across maximum-likelihood and minimum-residual extraction methods, the item was retained in the exploratory model. Its loading and the third factor are therefore interpreted cautiously.

Table 14 Factorability Diagnostics for Mobile-minus-Traditional/Card Difference Scores		
Diagnostic	Value	Interpretation
Respondents total	92	Total respondents included in the RQ4 difference-score dataset.
Respondents complete	92	All respondents had complete data for the 17 difference-score attributes.
Attributes	17	Seventeen mobile-minus-traditional/card paired attribute differences were analyzed.
Missing values	0	No missing values were present in the RQ4 difference-score matrix.
KMO overall MSA	0.692	Acceptable for exploratory factor analysis, with cautious interpretation.
Bartlett chi-square	824.719	Significant test supports factorability when $p < .05$.
Bartlett df	136	Degrees of freedom for Bartlett's test.
Bartlett p-value	$< .001$	The correlation matrix differs from an identity matrix.
Determinant of correlation matrix	5.77×10^{-5}	Very small values may indicate multicollinearity or near singularity.
Condition number of correlation matrix	48.951	Larger values indicate greater numerical instability.
Individual MSA values below .50	1	Items below .50 should be examined carefully before EFA.
Individual MSA values below .60	6	Items below .60 may be weak but can be retained if theoretically important.

Note. Difference scores are calculated as mobile-payment rating minus traditional/card-payment rating for each paired attribute. MSA = measure of sampling adequacy. EFA = exploratory factor analysis.

Table 14 confirms that the difference-score matrix was sufficiently factorable for exploratory analysis, while also supporting cautious interpretation because of the modest KMO value and the presence of one item with a low individual MSA.

A three-factor solution was estimated using maximum-likelihood extraction with varimax rotation. Varimax rotation was retained because it produced a clear and interpretable factor structure consistent with the comparative-value framework. To evaluate stability, the same three-factor structure was also estimated using the minimum-residual method. The corresponding maximum-likelihood and minimum-residual factors were highly congruent, with congruence values of 1.00, 1.00, and .99 for the three main factors. These results support interpreting the three dimensions as stable exploratory dimensions of comparative payment evaluation.

The three factors jointly explained approximately 50% of the variance in the seventeen difference scores. Model-fit evidence was mixed: the RMSR was .05 and the fit based on off-diagonal values was .97, but the RMSEA and TLI indicated that the solution should be interpreted as exploratory rather than confirmatory. This pattern is consistent with the study's purpose, the modest sample size, and the heterogeneous nature of the seventeen payment attributes.

Table 15 Exploratory Factor Analysis of Mobile-minus-Traditional/Card Attribute Differences						
Attribute	Construct	ML1	ML2	ML3	Communality	Uniqueness
Bonus for opening an account	Financial/Credit Value	—	0.561	—	0.380	0.620
Free or low-fee transactions	Financial/Credit Value	—	0.410	0.453	0.402	0.598
Credit for purchases	Financial/Credit Value	—	0.790	—	0.641	0.359
Interest on deposited balance	Financial/Credit Value	—	0.486	—	0.390	0.610
Warning of suspicious transactions	Operational Reliability/Risk Protection	0.365	0.428	—	0.318	0.682
Low-interest borrowing	Financial/Credit Value	—	0.544	—	0.369	0.631
Bonus for referring a friend	Financial/Credit Value	—	0.403	—	0.200	0.800
Easy transfer or balance combination	Convenience/Mobility	—	0.321	0.456	0.341	0.659
Large-transaction alerts	Operational Reliability/Risk Protection	—	—	0.995	0.995	0.005
Low interest on credit balance	Financial/Credit Value	—	—	0.608	0.491	0.509
Safe to carry and make payments	Convenience/Mobility	0.614	—	—	0.454	0.546
Malware or malfunction correction	Operational Reliability/Risk Protection	0.599	—	—	0.384	0.616
Protection of private information	Operational Reliability/Risk Protection	0.646	—	—	0.432	0.568
Convenient way to make payments	Convenience/Mobility	0.791	—	—	0.632	0.368
Safe payment transactions	Operational Reliability/Risk Protection	0.891	—	—	0.794	0.206
Accurate payment transactions	Operational Reliability/Risk Protection	0.867	—	—	0.751	0.249
Friendly service for disputes	Operational Reliability/Risk Protection	0.750	—	—	0.568	0.432

Note. Loadings are from the three-factor maximum-likelihood solution with varimax rotation. Loadings below |.30| are suppressed and shown as em dashes. ML1 = payment accuracy, safety, and convenience; ML2 = financial incentives and borrowing value; ML3 = transaction monitoring and credit-cost benefits.

Table 16 Factor Congruence Between Maximum-Likelihood and Minimum-Residual Three-Factor Solutions <i>ML = maximum-likelihood extraction; MR = minimum-residual extraction. Diagonal values show congruence between corresponding factors across extraction methods.</i>			
ML Factor	MR1	MR2	MR3
ML1	1.00	0.05	0.18
ML2	0.05	1.00	0.41
ML3	0.16	0.48	0.99

Tables 15 and 16 together show both the substantive three-factor loading pattern and the stability of that pattern across maximum-likelihood and minimum-residual extraction methods.

The first factor, *payment accuracy, safety, and convenience*, was defined by strong loadings for safe payment transactions, accurate payment transactions, convenient way to make payments, friendly service for disputes, privacy protection, safe to carry and make payments, and malware or malfunction correction. This factor indicates that Chinese consumers' comparative payment evaluations combine operational reliability, safety, privacy, convenience, and service reliability into a broad operational-performance dimension.

The second factor, *financial incentives and borrowing value*, was defined mainly by credit for purchases, account-opening bonus, low-interest borrowing, interest on deposited balance, referral bonus, and free or low-fee transactions. This factor captures the financial-credit side of payment preference, where consumers compare the economic benefits, incentives, and borrowing-related features of mobile and traditional/card payment systems.

The third factor, *transaction monitoring and credit-cost benefits*, was defined most strongly by large-transaction alerts and also included low interest on credit balance, easy transfer or balance combination, and free or low-fee transactions. Because large-transaction alerts had a low individual MSA and a very high loading, this factor should be interpreted cautiously. Substantively, however, it suggests a specialized dimension linking transaction monitoring with credit-cost and transfer-fee benefits.

Whereas Table 10 evaluates whether theory-based construct composites distinguish payment-mode observations, the RQ4 factor analysis examines how the paired mobile-minus-traditional/card attribute differences organize empirically into broader comparative-value dimensions.

Overall, the EFA provides exploratory evidence that the seventeen mobile-minus-traditional/card attribute differences are not isolated preferences. Instead, they are organized into broader comparative-value dimensions involving operational performance, financial-credit value, and transaction-monitoring or credit-cost benefits. These findings provide exploratory support for Equation (2), which conceptualizes mobile-minus-card/conventional payment preference as a function of differences in convenience/mobility, operational reliability and risk protection, financial-credit value, and ecosystem/institutional fit.

Thus, the EFA does not replace the theory-derived construct labels; rather, it shows how construct-relevant attributes combine empirically into broader comparative-value bundles in this sample.

LIMITATIONS, INSTITUTIONAL CONTEXT, AND FUTURE RESEARCH

Mobile-payment research remains relatively limited in contexts where mobile wallets have become deeply embedded in everyday consumer transactions. China provides an especially important setting because mobile payment has expanded through private technology platforms that connect consumers, merchants, banks, and other service providers. Alipay and WeChat Pay have made payment transactions simple, convenient, and widely accessible while linking payments to e-commerce, communication, investment, transportation, and other value-added services. These platform-based systems have also changed the role of banks and card issuers in payment processing and created new competitive and regulatory challenges. Because mobile-payment acceptance can reduce transaction frictions for merchants and consumers, especially in QR-code-based settings, China's institutional environment must be considered when interpreting consumers' comparative payment preferences.

The regulatory environment has evolved as mobile-payment platforms have expanded in scale and scope. Earlier policy priorities emphasized digital innovation and payment convenience, while more recent policy attention has focused on financial stability, data governance, competition, user protection, and the relationship between private technology platforms and the formal banking system. Regulatory measures affecting QR-code payments, merchant accounts, and private fintech platforms illustrate how government oversight can reshape the conditions under which mobile payments operate (Peter, 2020; Zhai, 2021; Zhang & Tang, 2022). These changes are especially relevant for small businesses and informal merchants that have relied on low-cost QR-code payment acceptance. The Covid-19 pandemic and related business disruptions further highlighted the importance of payment infrastructure for small firms (Mu, 2022). Regulatory uncertainty therefore matters because it can alter ecosystem and institutional fit, one of the conditions under which consumers evaluate whether mobile payments remain more useful than traditional/card alternatives.

The findings should be interpreted within several boundary conditions. China's widespread QR-code acceptance, mobile-wallet infrastructure, merchant adoption, and platform ecosystems make mobile payment unusually convenient relative to many national payment settings. At the same time, fee structures, official oversight, merchant acceptance rules, and the platform services surrounding Alipay and WeChat Pay can shape how consumers experience the relative value of mobile and traditional/card payment. Consumer familiarity with mobile payment in China may also make mobile wallets feel more routine and trustworthy than they would in markets where card payment remains the default. These contextual features are central to the manuscript's ecosystem/institutional-fit argument and help explain why consumer payment preferences may vary across national payment environments.

This study is preliminary and exploratory, and several limitations should be noted. The sample is modest in size, respondents were recruited through WeChat rather than through a

probability-based national sampling frame, and respondents were largely from southern China, where mobile usage was described as especially salient. The analysis also examines a limited set of payment-service attributes. As a result, the findings should be interpreted as evidence of comparative payment-value patterns within a mobile-oriented Chinese consumer context rather than as population-level estimates for all Chinese consumers. This limitation does not eliminate the value of the study; rather, it positions the findings as useful for theory development, contextual interpretation, and identifying comparative payment-value patterns that can be tested in larger and more representative samples.

Future research should examine larger and more diverse samples, incorporate additional digital-banking and payment-service variables, and test whether the dimensions identified here remain stable across regions, age groups, income levels, and levels of experience with mobile and traditional/card payment systems. Longitudinal research would also be useful for assessing whether younger consumers' reliance on smartphones for payment and banking activities leads to declining use of physical debit or credit cards over time. Cross-national research would be especially valuable because payment preferences are likely shaped by differences in payment infrastructure, merchant-acceptance patterns, regulatory systems, platform ecosystems, and the historical role of cards. For example, a U.S.–China comparison could clarify how consumer evaluations differ between a card-dominant market and a mobile-wallet-dominant market.

Overall, this study shows that Chinese respondents' comparative preferences for mobile and traditional/card payment are shaped by more than simple adoption of a new technology. The results suggest that mobile payment's comparative value is strongest when convenience/mobility, operational reliability and risk protection, and platform integration are high, while traditional/card systems retain value in selected financial-credit and risk-protection features. These findings offer useful insights for payment providers, banks, card issuers, merchants, and policymakers seeking to understand the attributes and institutional conditions that shape consumer payment-system preferences.

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