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# "Meet me at the backdoor": A multiple case study of academic entrepreneurs bypassing their technology transfer offices

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ABSTRACT

This article investigates the underexplored phenomenon of technology transfer office (TTO) bypassing in academic entrepreneurship. While TTOs are established to centralize and support intellectual property-based commercialization, a significant portion of entrepreneurial projects avoid the TTO. Relying on both economic (transaction cost theory) and ethical (Tyler's justice model) considerations, this study explores the motivations and contextual factors behind a researcher's decision to commercialize an invention using means other than the TTO. This multiple case study employs an in-depth exploratory qualitative approach to investigate five academic entrepreneurs across different disciplines in Canadian universities who chose to bypass their TTO, often in contravention of institutional policies. Our findings reveal a complex interplay among individual motivations, institutional policies, and market realities. We identified four paths of awareness and strategic intent in this process ranging from unintentional non-compliance to tactical avoidance which challenge a simplistic perception of TTO bypassing as merely unintentional rather than deliberate. The study also reveals four overlapping contexts that promote TTO bypassing: confidence in personal expertise, previous negative experience of using the TTO, peer-influenced skepticism, and external partner challenges. Furthermore, the findings show that the reasons for bypassing include both economic and ethical motivations which steer academic entrepreneurs toward alternative, privately managed commercialization paths. The article concludes with some implications for university managers and policymakers related to how to address the multifaceted motivations for TTO bypassing.

## 1. Introduction

In recent years, universities around the world have been focusing increasingly on converting scientific discoveries into marketable outcomes (Jacobsson et al., 2013). This shift is receiving active support from university administrators and has promoted the creation of specialized structures such as technology commercialization or technology transfer offices (TTOs) (Gianiodis et al., 2016) to facilitate academic entrepreneurship (Grimaldi et al., 2011; Jacobsson et al., 2013). TTOs play a crucial role in nurturing entrepreneurial skills (Siegel and Wright, 2015a), assessing the commercial potential of research (Uctu and Jafta, 2014), and supporting market entry (Abreu and Grinevich, 2012). Their importance for academic patenting (Ustundag et al., 2011), licensing (Siegel et al., 2007a), and spin-off creation (Clarysse et al., 2011; O'shea et al., 2005) is well established with some studies suggesting that they are central to successful university technology transfer (Sapah et al., 2022).

Despite the dominance of TTO management of intellectual property (IP)-based knowledge transfer (Link et al., 2007), there have been notable instances of IP commercialization which bypass the TTO (Collier et al., 2011). These alternative routes, variously termed "backdoor commercialization" (Siegel et al., 2007b), "the gray market of technology transfer" (Kenney and Patton, 2009), "TTO bypassing" (Collier et al., 2011), university invented (but not owned) patents (van Burg et al., 2021), "organizational deviance" (Waldman et al., 2022), or "empirical anomalies" (Thursby et al., 2007), represent significant divergence from the traditional process. Indeed, TTO bypassing is often viewed negatively for potentially depriving the university of revenue (Markman et al., 2008) but is linked intrinsically to academic entrepreneurship (Gianiodis et al., 2016). While the role of the TTO as a pivotal intermediary in formal academic commercialization has been investigated in depth (Hsu et al., 2015; Libaers et al., 2006; Shen et al., 2022; Tello et al., 2011), the less favored behavior of TTO bypassing has received scant attention (Goel and Göktepe-Hultén, 2017; Huyghe et al., 2016). Also, among the few studies assessing the prevalence of TTO bypassing (Aldridge and Audretsch, 2010; Gianiodis et al., 2016;

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Markman et al., 2008), an even smaller number focus on the rationale for this "anomaly" (Litan et al., 2007; Sellenthin, 2009) and the patterns involved in unintentional (Halilem et al., 2017; Huyghe et al., 2016) and deliberate bypassing (Goel and Göktepe-Hultén, 2017; Rooksby, 2016). While the former strand of work mostly suggests lack of awareness of institutional rules, only the latter sees it as a deliberate decision which suggests a different interpretation of the phenomenon of TTO bypassing. Yet, in this small stream of work on intentional TTO bypassing, this behavior is often seen as a binary choice between formal commercialization of academic research using the TTO or not. However, as Balven et al. (2018) hypothesize, TTO bypassing can involve creative ways of circumventing the formal technology transfer process that may not strictly infringe university policy or laws. This lack of nuance in our interpretation of this phenomenon limits our understanding of the full spectrum of TTO bypassing behaviors. Also, studies exploring the reality of TTO bypassing face the significant methodological challenge that they are investigating a phenomenon that is inherently clandestine. To address this difficulty, Waldman et al. (2022) examined the intention to bypass the TTO from the point of view of a broad population of researchers that included those with experience of using the TTO, those able to envision themselves as entrepreneurs, including many for whom academic entrepreneurship was not directly relevant. However, a full understanding of TTO bypassing requires much deeper examination of the perspectives of the actors involved and the underlying motivations and contextual factors for bypassing the academic TTO. To our knowledge, none of the existing research focuses on "academic entrepreneurs who have already bypassed their TTO." A final consideration is that while for academic entrepreneurs, bypassing the TTO is related to finding the best way to commercialize their research results which is in line with an economic rationale and transaction cost theory (TCT), it also has some moral and social implications. For instance, most institutional policies define the researcher's legal obligation regarding the disclosure of inventions, and ownership and revenue sharing (Halilem et al., 2017). Thus, this context is also subject to ethical theorizing because academic entrepreneurship involves both personal and financial considerations and institutional obligations, legal norms, and the perceived legitimacy of university policies. Theories such as the Tyler's justice model (TJM) are useful to capture the compliance, authority, legitimacy, and moral judgment of academic entrepreneurs involved in TTO bypassing. In our view, the present study addresses some of these gaps in the literature by examining the following central research question: How do academic entrepreneurs choose to bypass their TTO, and what are the underlying motivations, contextual factors, and ethical considerations that shape their decisions?

Our study diverges from the existing research and contributes in several ways to work on academic entrepreneurship. First, most studies of TTO bypassing are quantitative (Aldridge and Audretsch, 2010; Balven et al., 2018; Dahlborg et al., 2017; Huyghe et al., 2016; Waldman et al., 2022) and focused primarily on assessing its prevalence or exploring its contextual antecedents. The present paper contributes by providing a qualitative examination of the contextual factors and motivations driving TTO bypassing from the perspectives of academic entrepreneurs who have chosen this path which fills a notable gap in the current literature. Second, most research frames TTO bypassing within an economic rationale based on TCT (Goel and Göktepe-Hultén, 2017), agency theory (Markman et al., 2008), or information processing theory (Huyghe et al., 2016) with until recently only scant consideration of fairness-related reasons for bypassing (Waldman et al., 2022). To obtain a more complete understanding of academic entrepreneurial behavior requires examination of both the economic and ethical considerations involved (Åstebro et al., 2018; Geuna and Rossi, 2011; Kochenkova et al., 2016; von Proff et al., 2012). The present paper looks at both aspects and aims to provide a better understanding of the diverse rationales for TTO bypassing. It responds to calls for deeper insights into the motivations for deliberate TTO bypassing (Goel and Göktepe-Hultén, 2017; Huyghe et al., 2016; Markman et al., 2008) and seeks to enrich the theoretical discourse by examining why academic entrepreneurs choose to operate independently of the TTO. In doing so it addresses several gaps in the literature and contributes to a more holistic theoretical explanation of the bypassing phenomenon.

In practice, TTO bypassing is a problem for university administrators since it can reduce the institution's returns from research and innovation (Markman et al., 2008). Additionally, bypassing the TTO undermines the TTO's efforts to extend the university's influence and sustain operational costs (Markman et al., 2008). Also, academic inventors who circumvent their TTOs miss out on important commercialization support (Huyghe et al., 2016) and risk legal disputes with their university over invention disclosure and revenue sharing (Grimaldi et al., 2011).

Section 2 begins by defining and estimating the extent of TTO bypassing and then reviews the literature on the reasons and theories behind academic commercialization bypassing. Section 3 describes the methodology and the case studies. Section 4 presents the results. Section 5 sets out some implications of our research and suggests that while debate focuses mostly on the divergent interests and cultural incompatibilities of academic inventors and TTOs, we suggest that more attention should be paid to the multifaceted motivations for TTO bypassing.

## 2. Literature review

### 2.1. Estimating the phenomenon of academic commercialization bypassing

TTO bypassing in academic entrepreneurship has been interpreted in numerous ways. In its broadest interpretation, it refers to the efforts of faculty members to transfer technology through some other than the conventional TTO pathway, and includes both informal and formal commercialization activities (Balven et al., 2018). However, informal entrepreneurial activities such as consulting services, generally do not involve formal legal instruments (e.g., IP rights) and fall outside the TTO's purview (Dahlborg et al., 2017). Consequently, many definitions of TTO bypassing are centered on IP-based knowledge transfers such as patents (Aldridge and Audretsch, 2010; Thursby et al., 2009). Lists of the patents awarded to universities are available from several international and national organizations (Gianiodis et al., 2016; Jacobsson et al., 2013) but there is no information on the faculty members who circumvent their TTOs, which represents a significant gap in the data on academic patenting (Huyghe et al., 2016; van Burg et al., 2021).

Thus, some studies rely on operational definitions firstly based on perceptions. Krucken (2003) interviewed TTO representatives, university administrators, and representatives of chambers of commerce in Germany, prior to the abolition of professor privilege. This legislation granted academic inventors direct ownership of their inventions (von Proff et al., 2012). Krucken (2003) estimated that for every formal commercialization initiative via a TTO, there were nine (90 %) other projects that had bypassed the TTO. Other studies have explored more factual operational definitions in the context of legislation such as the US Bayh-Dole Act that mandates disclosure of inventions arising from publicly funded research to the university concerned which then retains ownership of the invention (Grimaldi et al., 2011). The studies by Thursby et al. (2009), Markman et al. (2008), and Gianiodis et al. (2016) use similar methodologies and their respective findings show that 36 % of 5818 patents granted between 1993 and 2004, 33 % of 7650 patents granted between 1999 and 2003, and 42 % of 10,304 patents granted between 2000 and 2007 were assigned not to a university, but to researchers. These high percentages show that, despite institutional policies, many patents are assigned to their US academic inventors and not the relevant universities. Also in the US context, Waldman et al. (2022) employed a 7-item index to track activities independent of TTO involvement including clinical trials, meetings with people from industry, and patent filing. However, Waldman and colleagues' study blends potential and actual commercialization outcomes (meeting

industry contact vs, filing a patent) but does not assess the prevalence of the phenomenon.

Nevertheless, another layer of complexity arises when patents are assigned to private funders of research, as contractual agreement related to the funding may allow the TTO to be bypassed legally (Arza and Carattoli, 2017; Verspagen, 2006). This situation has resulted in a strand of work on the bypassing phenomenon which considers only commercialization that bypasses the TTO of publicly funded research (Aldridge and Audretsch, 2010). Aldridge and Audretsch (2010) show that nearly 30 % of scientists funded by the National Cancer Institute resorted to 'backdoor' commercialization for at least one patent. Similarly, a study by Goel and Göktepe-Hultén (2017) focused on Max Planck Society funded German researchers whose employment contracts implied that inventions by Max Planck staff members are considered employee inventions and belong to the Society. They found that 33 % of patent-active researchers bypassed the TTO for at least one of their patents. Finally, a study by Sellenthin (2009) adopts a slightly different perspective and rather than looking at patent ownership investigates the extent of patent applications with no TTO support. Sellenthin (2009) found that between 2002 and 2004, up to 79 % of patent-active researchers in Sweden (where professor privilege still applied) and 53 % in Germany (following abolition the professor privilege) bypassed their TTO.

Taken together, these studies exemplify the multifaceted nature of bypassing behavior in academic research commercialization and suggest three main conclusions. First, bypassing is a significant aspect of IP-based academic commercial knowledge transfer, with factual estimates ranging from 29.8 % (Aldridge and Audretsch, 2010) to as high as 79 % in certain contexts (Sellenthin, 2009). Second, researchers who choose to bypass the TTO for some of their inventions may not do so consistently; for some projects, they may choose to use the TTO but choose not to for others (Aldridge and Audretsch, 2010). Third, even in contexts where patent disclosure is legally mandated, a substantial proportion of academic entrepreneurs continue to bypass the TTO, and infringement is more frequent in countries without legal rules such as in countries before abolition of professor privilege (Huyghe et al., 2016; Markman et al., 2008). These conclusions underscore the importance of the bypassing phenomenon within the broader university-industry knowledge transfer context (Abreu et al., 2016; Bonaccorsi, 2017; Brescia et al., 2016).

### 2.2. Understanding bypassing pathways

The scarce discourse on academic commercialization bypassing identifies two types of bypassing behavior: unintentional and deliberate (Goel and Göktepe-Hultén, 2017; Huyghe et al., 2016), see Table 1 for the key dimensions of these behaviors. Unintentional bypassing suggests that the researcher inadvertently chooses a different commercialization process due to lack of awareness of the TTO's existence (Huyghe et al., 2016) or lack of familiarity with invention disclosure rules (Halilem et al., 2017). For instance, Huyghe et al. (2016) apply the psychological theory of information processing to understand why researchers might not be aware of the TTO.

In the context of TTO bypassing, this theory suggests (Ucbasaran et al., 2009) that researchers heavily immersed in their research, teaching, and administrative responsibilities may not engage fully with the complex university information landscape and the rules related to IP, negotiation, and marketing (Geuna and Rossi, 2011; Grimaldi et al., 2011; Siegel and Wright, 2015a). For instance, a survey by Huyghe et al. (2016) found that 56 % of 4515 academic researchers in Germany were unaware of the TTO, although the likelihood of awareness increased by 62 % among researchers with entrepreneurship experience. Another survey by Halilem et al. (2017) found that 15.3 % of 449 Canadian faculty members applying for patents were ignorant of the university's invention disclosure policies. These findings suggest that unintentional bypassing due to lack of awareness can occur although likely limited to a minority of academic entrepreneurs. Conversely, deliberate bypassing suggests that the researcher consciously chooses to circumvent the TTO (Rooksby, 2016). However, Balven et al. (2018) challenge this simplistic dichotomy and theorize that academic entrepreneurs might employ a range of creative strategies to circumvent the formal technology transfer procedure that do not necessarily violate institutional policies or the legal framework. However, empirical work on TTO bypassing relies predominantly on quantitative methodologies which tend to enforce binary classifications of behavior (Aldridge and Audretsch, 2010; Balven et al., 2018; Dahlborg et al., 2017; Huyghe et al., 2016; Waldman et al., 2022) and do not consider the nuanced and diverse strategies used to bypass TTOs. This gap in the literature suggests the need for a more granular understanding of TTO bypassing that considers it in terms of a spectrum of behaviors rather than a binary phenomenon.

**Table 1**
Comparison of Key Dimensions in Unintentional vs. Intentional TTO Bypassing.

| Key dimension | Unintentional TTO Bypassing | Intentional TTO Bypassing |
|---|---|---|
| Awareness of TTO | Lack of awareness of the TTO's existence (Huyghe et al., 2016). | Conscious choice to avoid using the TTO despite awareness (Rooksby, 2016). |
| Familiarity with Invention Disclosure Rules | Inadvertent avoidance due to lack of familiarity ( Halilem et al., 2017). | Deliberate circumvention despite knowing the rules ( Halilem et al., 2017). |
| Cognitive Engagement | Limited engagement with university information due to research focus (Huyghe et al., 2016). | Intentional disengagement based on cost-benefit analysis (Goel and Göktepe-Hultén, 2017) and other considerations (Waldman et al., 2022), |
| Perceived Utility of TTO Services | Unaware of potential benefits due to lack of information. | Perceives TTO services as inadequate or unhelpful ( Gianiodis et al., 2016). |
| Legal and Ethical Considerations | Unintentional non-compliance with institutional rules ( Waldman et al., 2022). | Evaluates and potentially rejects institutional rules based on fairness and moral judgments (Shane and Somaya, 2007). |
| Role of Institutional Legitimacy | Does not fully recognize the institutional role due to lack of engagement (Halilem, 2010). | Acknowledges but chooses to bypass due to perceived unfairness or lack of legitimacy (Martinelli et al., 2008). |
| Theories | Psychological theory of information processing ( Huyghe et al., 2016) | TCT (Goel and Göktepe-Hultén, 2017), agency theory (Markman et al., 2008), organizational justice theory (Waldman et al., 2022) and the TJM |

### 2.3. Intentional TTO bypassing and economic and ethical considerations

Deliberate bypassing of TTOs examined through multiple theoretical lenses reveals the influence of both economic and ethical/legal considerations. In the case of economic considerations, on the one hand, the relationship between the TTO and the academic entrepreneurs can be modeled based on agency theory (Gianiodis et al., 2016; Markman et al., 2008) with the academic researcher as the agent and the TTO/university as the principal. In this case, the agent might rely on informal entrepreneurship through bypassing to act opportunistically, while the principal will try to align its agents through monitoring and incentive systems. Agency theory has been mobilized predominantly to explain the relationship between the academic entrepreneur and the TTO in the upper organizational echelon of institutional governance (Bojko et al., 2021; Parente et al., 2011). For example, both Markman et al. (2008) and Gianiodis et al. (2016) concede that while bypassing is the result of the scientist's individual-level decision making, they examined the phenomenon at the organizational level. Agency theory tends to emphasize incentive misalignment between principal and agent to

explain some conflicts. However, it cannot capture the full complexity of the academic entrepreneur's decision to bypass the TTO which might be driven by factors other than incentive misalignment and could be due to individual dissatisfaction with the TTO process (Boehm and Hogan, 2014) or perception of TTO inefficiency (Fai et al., 2018). Some works use TCT as a framework to understand the decision-making processes in various organizational contexts including academic entrepreneurship (Shen et al., 2022; Wood, 2009). TCT examines the costs associated to an economic transaction, and provides a valuable lens for examining how different governance structures impact the costs associated to commercialization of academic research outcomes - particularly those related to planning, adapting, and monitoring activities (Goel and Göktepe-Hultén, 2017). While TCT is also applied mostly at the institutional or organizational level to understand these dynamics (Shen et al., 2022; Wood, 2009), some studies employ it at the individual level to explore how academic entrepreneurs make strategic decisions (Chang et al., 2015; Clauss and Kesting, 2017). In the context of studying TTO bypassing by individual entrepreneurs, TCT provides a useful lens to understand the behavior of academic entrepreneurs whose decisions are likely influenced by their perceptions of several critical organizational dimensions (Arshad et al., 2018; Coupet and Dickens, 2024; Hertzfeld et al., 2006; Tietze, 2012). These dimensions include: 1. Asset Specificity which refers to the ability of the TTO (its assets) to reduce the costs associated to commercialization; 2. Uncertainty which refers to the researcher's perception of the TTO's capacity to successfully commercialize an invention and reduce the potential risks and unpredictability inherent in the commercialization process, 3. Bounded Rationality which refers to the perceived cognitive limitations of TTO staff related to processing and analyzing information regarding the inventions and its commercialization, 4. Opportunism which refers to the TTO's capabilities to negotiate with private partners to increase the revenue for the university and the academic entrepreneur, and allow revenue sharing to benefit the academic entrepreneur. For instance, for the academic inventor bringing an academic invention to market implies various costs related for example to evaluation, protection, partner search, negotiation, and transfer (Borges and Jacques Filion, 2013; Wood, 2011). The monetary (financial) and nonmonetary (time) costs especially for those with scant experience of IP systems can be significant barriers to commercialization (Baldini et al., 2007; Sellenthin, 2009). Also, the nascent nature of academic inventions can elevate these costs (Sellenthin, 2009). The university TTO is seen as an institutional mechanism which facilitates the transfer of technology and reduces these costs for the academic entrepreneur (Ustundag et al., 2011). However, empirical evidence suggests that perceptions of TTO effectiveness are mixed. Some academic entrepreneurs consider TTO services to be inadequate or unhelpful (Gianiodis et al., 2016; Huyghe et al., 2016) as shown by a German Ministry of Research and Education survey in which 58 % of respondents (which included university administrators, academic inventors, and firms) expressed doubts about the usefulness of intermediaries such as TTOs (Kienbaum., 2006). The survey by Goel and Göktepe-Hultén (2017) of 2500 Max Planck Society researchers in Germany explored whether the perceived financial and time costs of engaging with the TTO led to TTO bypassing. However, their results lack statistical significance which highlights the problems in measuring this phenomenon quantitatively. Also, while several studies explore how TTO efficiency influences successful research commercialization (Sart, 2013; Secundo et al., 2019; Siegel and Wright, 2015b), the relationship between perceived inefficiencies at the individual level and the decision to bypass TTOs has only been hypothesized (Waldman et al., 2022). Despite theoretical assertions, empirical research is needed to understand how economic considerations might influence the act of bypassing the TTO.

Also, while TCT offers a robust framework to understand the economic rationale behind TTO bypassing, it may not fully encompass the broader complexities of the phenomenon such as the legal and ethical dimensions (Åstebro et al., 2018; Geuna and Rossi, 2011; Kochenkova et al., 2016; von Proff et al., 2012). Indeed, academic entrepreneurs operate within an institutional context that imposes legal obligations such as disclosure of inventions and sharing of ownership and revenue (Halilem et al., 2017). In this case, bypassing the TTO is related to both minimizing transaction costs and managing the legal responsibilities and ethical considerations involved (Balven et al., 2018; Holley and Watson, 2017; Waldman et al., 2022). The ethical perspective has received attention only recently, for instance, by Waldman et al. (2022) who introduce organizational justice theory. While this theory is useful for examining workplace fairness and the impact on employee behavior, it does not directly address compliance, authority, legitimacy, and moral judgment issues which are critical for understanding why academic entrepreneurs might choose to circumvent their university TTO. TJM offer a more compelling framework to address the critical question of TTO bypassing and why individuals choose not to comply with university regulations. TJM was developed originally to explore perceptions of procedural fairness and legitimacy within legal and governance contexts. It emphasizes the importance of how individuals perceive the fairness of procedures and the legitimacy of authorities which in turn, significantly influences their willingness to adhere to established rules (Narcisse and Harcourt, 2008; Sapienza et al., 2000). When applied to the phenomenon of TTO bypassing, TJM suggests that academic entrepreneurs' actions could be shaped by their perceptions across several key dimensions (Qin, 2019; van Burg et al., 2013; Waldman et al., 2022): 1. Procedural Justice which refers to the transparency and impartiality of the TTO's rules and procedures and perceived absence of bias, 2. Distributive Justice which refers to perception of fairness in the distribution of recognition and other benefits associated with an invention, 3. Interpersonal Justice which refers to how much the academic entrepreneur feels respected, valued, and fairly treated by TTO staff, 4. Informational Justice which refers to clarity, completeness, and accessibility of information provided by the TTO on its rules and procedures, and 5. Legitimacy of Authority which refers to how the academic entrepreneur perceive TTO authority over the invention and the commercialization process. The interplay among these dimensions reveals some nuances related to how the individual entrepreneur rationalizes his or her actions related to compliance with institutional rules based on the entrepreneur's perception of the fairness and the legitimacy of the institutional rules. These nuances in turn reveal the ethical motivations behind behaviors. For instance, perceptions of unfair revenue sharing or ownership claims could either discourage inventions commercialization by the academic inventor (Halilem et al., 2017) or encourage commercialization through an alternate route (Perkmann et al., 2013; Waldman et al., 2022). Waldman et al. (2022) investigated how perception of institutional fairness shaped academic researchers' intentions related to informal technology transfer. They found a link between such perception and the intention to bypass the TTO but not between the intention and the actual bypassing behavior. The authors note that while intention typically predicts behavior, this link is weakened or breaks in the presence of a perceived risk such as in the case of TTO bypassing (Waldman et al., 2022). This lack of statistical significance in results on TTO bypassing behavior further highlights the problems related to quantitative examination of this phenomenon and emphasizes the need for a better understanding of how legal and ethical issues translate into bypassing actions. TJM has been applied to various contexts including public service organization employees (Narcisse and Harcourt, 2008) and entrepreneurs (Sapienza et al., 2000) but has not been used explicitly to explain academic bypassing.

Thus, both TCT and TJM address different subdimensions that matter for our understanding of TTO bypassing. These differences suggest the advantages of integrating both theoretical perspectives in a study of the factors influencing academic entrepreneurs' decisions to circumvent their institutions' TTOs. The present study also addresses the specific questions of:

1. How do academic entrepreneurs use unintentional and deliberate behaviors to navigate the informal commercialization process? And what are the implications for TTO bypassing?
2. How do economic and ethical considerations influence the academic entrepreneurs' decision to bypass the university TTO? And which theoretical frameworks best explain the rationalization behind these actions?

## 3. Methodology

We employ an exploratory research method to investigate the relatively unexamined gray market of technology transfer. The lack of work in this field and the lack of statistically significant findings in the few existing quantitative studies (Goel and Göktepe-Hultén, 2017; Waldman et al., 2022) call for a methodology that can investigate these underexplored aspects of academic entrepreneurship bypassing and overcome the frequent negative biases in existing work on this topic (Markman et al., 2008). We use a qualitative exploratory case study approach to probe areas where little is known about a reality (Benbasat et al., 1987). Yin (2003) suggests using case studies to address 'how' and 'why' questions, and especially if the phenomena being investigated are contemporary and occur in real-life contexts that are beyond the researcher's control. We employ a multiple case study design inspired by Eisenhardt (1989) and Yin (1994) to generate diverse outcomes from the selected cases.

### 3.1. Study population

Our research focuses on the Canadian academic sector which has a long history of managing academic invention commercialization (Sá and Kretz, 2016). Indeed, the first TTO in Canada was officially established in 1924 to promote the use of scientific results (Piper, 2018). In the 1980s, following the passing of the Bayh-Dole Act in the US, the number of TTOs in Canadian universities increased (Smyth et al., 2016). Currently all major Canadian universities have a TTO that is responsible for coordinating university employees' commercialization activities (Rasmussen, 2008). However, more than four decades after the Bayh-Dole Act, no similar law has been implemented in Canada (Fai et al., 2018; Kenney and Patton, 2011), and the strategies in place to promote research commercialization are diverse at both the federal and provincial levels (Rasmussen, 2008). Also, while Canadian universities tend mostly to be public universities (Valverde et al., 2020), with public funding for research almost four times higher than the amount of funding provided by industry (Smyth et al., 2016), the Canadian higher education system is decentralized (Rasmussen, 2008). Thus, Canadian universities present a range of different approaches to IP ownership, IP strategies, and technology transfer management (Halilem et al., 2017).

Also, inconsistent data, the extended timeframes involved, and the multifaceted nature of university-industry knowledge transfer make it difficult to measure the performance of TTOs (Fung et al., 2007). However, since 1991, the Association of University Technology Managers (AUTM) has conducted annual surveys which collect data on licensing income, invention disclosure, patents pending, and start-up creation in the U.S., with 36 Canadian TTOs participating voluntarily since 2005 (Fung et al., 2007). These data have enabled more detailed study of Canadian TTO performance (Aksoy and Beaudry, 2021) and show that on average, U.S. and Canadian universities produce similar numbers of patents and licenses per research dollar (Fung et al., 2007). While on average, U.S. institutions generate higher amounts of licensing revenue, Canadian TTOs license over 50 % of their IP (Fung et al., 2007; Smyth et al., 2016). The data show also, that despite Canada's strong research base, many technologies never reach the market which suggests significant room for improvement in terms of commercialization of innovations (Fung et al., 2007; Smyth et al., 2016). Also, although initially in Canada venture capitalists were investing more in early-stage opportunities, since 2000s their interest has waned compared to their U.S. counterparts (Lortie, 2019). Finally, the AUTM data show that, on average, the revenue generated by Canadian TTOs barely covers their operational costs and most are subsidized from university budgets (Smyth et al., 2016). This chimes with the findings in Abrams et al. (2009) that only 16 % of U.S. TTOs are self-sustaining.

To conclude, this varied institutional entrepreneurship policy setting (Galushko and Sagynbekov, 2014) alongside Canada's long experience of commercializing research (Link et al., 2014; Smyth et al., 2016), provides a compelling study context. Several previous studies compare Canadian universities to those in other developed countries such as the U.S., Spain, and Portugal (Gómez and Rodríguez, 2016; Razgaitis, 2007), and emerging/developing countries such as China and Brazil (Morrison, 2014; Yu et al., 2022). Thus, our core study sample includes academic entrepreneurs in Canada who bypassed their TTO for commercialization at least once. Identifying these individuals was not straightforward due to the clandestine nature of the activity involved and lack of a comprehensive list of "backdoor" commercialization (Huyghe et al., 2016). We employed a three-pronged identification strategy consisting of scrutinizing news articles for litigation over IP rights between a Canadian university and one of its employees, snowballing based on recommendations from other academic entrepreneurs, and an invitation issued to researchers at universities with a TTO to participate in the study (see the appendix for a list of the universities contacted). This method was informed by the proposals in Clayman (2004), Hen (2010), and Halilem et al. (2017) and supplemented by web-based search and confirmation using Association of University Technology Managers data which are used extensively in the literature (Gianiodis et al., 2016; Hsu and Ken, 2014; Jacobsson et al., 2013; Prets and Slate, 2016).

Sampling was aimed at achieving data saturation – the point where additional data collection was not adding new information or insights (Eisenhardt, 1989). In other words, data collection continued until we observed data redundancy and theoretical saturation (Eisenhardt, 1989). Table 2 shows that the analysis identified 96 first-order codes derived from a total of 15,173 words across the five cases. These codes informed the reasoning around and interpretation of the phenomenon through the lenses of TCT and TJM. Our analysis revealed nine theoretical framework subcategories (2nd-order codes) which emerged after analysis of the first three cases. This indicates saturation related to the primary conceptual categories. However, following Eisenhardt's (1989) guidelines, we continued data collection to include two additional cases (4 and 5). As anticipated and shown in between-case contribution analysis (Table 2), these additional cases did not result in new subcategories, confirming that data saturation had been achieved. The final sample size of five cases is in line with Eisenhardt's (1989) recommendations about the number of cases required to develop robust theory. Also, this approach is consistent with previous research on academic entrepreneurship which achieved data saturation after a small number of cases. For example, in Brantnell and Baraldi (2020) study of academic inventors navigating multiple institutional logics saturation was achieved after four cases. Similarly, Sooampon and Igel (2014) reached saturation with six cases of university researchers to explore the antecedents of their entrepreneurial decisions, while Ewango-Chatelet (2019) examination of academic professionals' entrepreneurial projects achieved saturation after six cases. Thus, the small number of cases included in the present study is justified by early achievement of data saturation and ensures comprehensive analysis grounded on empirical data.

### 3.2. Final sample

The final sample (see Table 3) includes a range of personal characteristics, experience, and contextual factors among entrepreneurs who bypassed their TTO at least once. The data include entrepreneur age, gender, previous commercialization experience, and institution legal obligations. The final sample includes four male entrepreneurs and one

**Table 2**
Contributions of cases to the studied phenomenon (codes, words, themes, subcategories).

| Case | Number of codes identified | Total number of words for all the codes | Distribution of codes under the TCT theme | Distribution of codes under the TJM theme | Case's unique contribution to the identification of the 9 subcategories (number of categories) | Between case contribution to the identification of the subcategories (total of 9 categories) |
|---|---|---|---|---|---|---|
| Case 1 | 19 | 2049 | 10 | 9 | 7 | 77 % |
| Case 2 | 18 | 2480 | 7 | 11 | 5 | 11 % |
| Case 3 | 7 | 1953 | 6 | 1 | 3 | 22 % |
| Case 4 | 23 | 3944 | 13 | 10 | 6 | 0 % |
| Case 5 | 29 | 4747 | 21 | 8 | 7 | 0 % |
| Total | 96 | 15,173 | 57 | 39 | 9 | 100 % |

**Table 3**
Description of the cases.

| Case | Age | Numerous experiences of commercial | Previous experience. With the TTO | Mode of commercial. | Source of the invention | Break institutional rules? |
|---|---|---|---|---|---|---|
| Case 1 | 50–60 | No | Previous experience | Spin-off | Internal | No |
| Case 2 | 40–50 | Yes | Interaction but no experience | Licensing | Internal | Yes |
| Case 3 | 50–60 | Yes | Previous experience | Licensing | Internal | Don't know (yes) |
| Case 4 | 60–70 | Yes | No experience | Licensing | External | Yes |
| Case 5 | 50–60 | Yes | Previous experience | Spin-off | From another university | Yes |

female entrepreneur ranging in age between 40 and 70 years. This distribution is in line with previous studies which show that on average, academic entrepreneurs are aged over 40, and generally are on an established career path (Goel and Grimpe, 2012; Klofsten and Jones-Evans, 2000; Stuart and Ding, 2006). The distribution is in line also with studies suggesting that female scientists are less likely than their male counterparts to disclose their invention to the university (Colyvas et al., 2012), to patent (Halilem et al., 2022), or to create spin-offs (Kochenkova et al., 2015). Also, prior to their TTO bypassing experience, four of the sample entrepreneurs had commercialized an invention and two had collaborated with the TTO. In terms of invention characteristics, four had developed an invention based on their research results, and one had worked on an invention developed with a private partner.

In exploring the institutional contexts of our respondents, we examined their awareness of institutional rules and whether they consciously adhered to or violated these rules during their TTO bypassing experience. This inquiry was complemented by an analysis of internal documents, particularly those pertaining to ownership assignment (drawn primarily from collective agreements and other internal policies). Throughout their entrepreneurial journeys, all respondents encountered and had been required to interpret complex legal documents related to IP. Although the complexity of these legal frameworks was acknowledged and was criticized by all the respondents (with one case seeking legal advice, see 4.3.2 for a discussion of TJM-related reasons to bypass), each of the respondents demonstrated a valid understanding of ownership assignment. This finding is in line with previous studies that suggest that academic entrepreneurs with prior commercial experience have higher levels of institutional knowledge about academic entrepreneurship (Huyghe et al., 2016; Halilem et al., 2017). Also, in the context of ownership assignment, four respondents operated under an automatic assignment regime, and one was subject to negotiated assignment. Under automatic assignment (Geuna and Rossi, 2011), ownership typically is assigned to the employer based on public funding of the research and substantial use of institutional resources by the employee/researcher during the research process (Hayter and Rooksby, 2016; Neumeyer, 1971). However, under automatic assignment if the invention is deemed to have limited commercial potential and the TTO is reluctant to invest significant resources in securing the IP, ownership can be reassigned to the academic inventor (Smith, 2011). In contrast under the negotiated assignment regime (Geuna and Rossi, 2011), the academic inventor has more leverage and is more able to retain partial or full ownership depending on the outcomes of negotiations with the TTO or the university more broadly (Crespi et al., 2010). Note that the entrepreneur in case 1 opted to retain ownership, bypass the TTO, and forfeit the TTO services (see section 4.1 for a discussion on different paths to TTO bypass). In summary, four respondents had engaged in backdoor commercialization in contravention of institutional regulations, and one had bypassed the TTO using legal means. The prevalence of universities with automatic assignment of IP rights reflects the common legal framework in many countries which grants the institution ownership of innovations developed within their walls (Ramli and Zainol, 2023).

Additionally, in examining the characteristics of the respondents' universities and their respective TTOs, we distinguished between TTOs' mission statements and the services they actually provide, based on publicly available documents and the collected data. Fitzgerald and Cunningham (2016) point out that the mission statement is the core expression of the unit's defining purpose, while the services provided tend to offer a better understanding of the outcomes of technology transfer (Olaya-Escobar et al., 2020). Although all TTOs are committed to supporting the commercialization of academic research, their specific emphases vary. For example, two TTOs stated that they prioritize maximizing the economic and social benefits of research, while another TTO emphasized assisting researchers to establish cross-sector partnerships and claimed to offer comprehensive support for knowledge transfer and commercialization. Two other TTOs emphasize stimulating the local economy by encouraging the creation of spin-off companies and fostering partnerships. These diverse objectives exemplify what the literature describes as the TTOs' complex roles as process catalysts, knowledge converters, and impact amplifiers (Faccin et al., 2022). The differences in their focus reflect the search for a balance between facilitating partnerships (process catalyst), enabling knowledge exchange (knowledge converter), and amplifying the societal and economic impacts of academic research (impact amplifier). The services provided by TTOs also show similarities and differences in their approaches to supporting researchers and facilitating commercialization. One TTO offers comprehensive support, based on identifying potential partners, managing collaborative agreements, and providing guidance related to knowledge transfer and innovation valorization. Other TTOs

emphasize collaboration with local business leaders and provision of networking opportunities, mentoring, and resources to help researchers and entrepreneurs develop their enterprises. These TTOs also prioritize connecting academic inventors with industry partners for further development and commercialization of inventions. Some TTOs provide a structured commercialization process that includes IP protection and active search for partners in the case of promising technologies. Some also provide educational programs to enhance IP awareness and entrepreneurial skills among university faculty. All of these services are aimed at supporting research commercialization and tailoring offers to specific institutional and regional needs. The services described are in line with the findings in Landry et al. (2013), who show that Canadian TTOs offer a range of services from prototyping, IP application, access to capital, and networking. Thus, the diversity in our sample of respondents and in their contexts provides a comprehensive perspective which enhances the robustness of our findings (see Table 2).

Respondents were recruited between March and July 2017. Data collection took place between May and July 2017 and was based on semi-structured interviews which lasted between 45 and 75 min. All interviewees were assured of data confidentiality and anonymity. The interviews were digitally recorded and transcribed verbatim and supplemented by secondary online information about the researchers and their ventures. The interview transcripts and secondary documents combined amounted to 145 pages of data.

### 3.3. Data collection

To ensure consistency and minimize bias, we used a structured interview guide based on the recommendations in Yin (1994) to ensure that questions were non-suggestive and authentic. The questionnaire was pre-tested with one researcher and one TTO employee to ensure comprehension. These two pilot interviews and their results are not included in the cases analyzed. The same interviewer conducted all the interviews. The questions covered a broad range of topics including details of the entrepreneur's most recent backdoor commercialization, experience of using or not the TTO, reasons for bypassing the TTO, the advantages and disadvantages of bypassing the TTO, and suggestions for improving institutional support for academic entrepreneurs who decided to bypass the TTO. Open-ended questions such as "Could you describe this?" "How?" and "Why?" triggered provision of more detail (Kontinen and Ojala, 2011). To ensure spontaneity and truthful responses, interviewees were not given access to the interview guide. Our approach is in line with retrospective studies (Huber and Power, 1985; Miller et al., 1997) and focuses on academic entrepreneurs' previous experience. Also, following the recommendations in Svendsen (2006), in order to foster mutual trust interviews began with a series of neutral and unthreatening questions. However, all our interviewees proved to be enthusiastic and keen to provide information on their consideration of the ethical and legal aspects of their entrepreneurial decisions.

### 3.4. Data analysis

The data analysis was informed by a literature-based "start list" (developed during the research process) of TCT and TJM related codes (Miles and Huberman, 1994). We employed multiple analysis strategies in line with Yin's recommendations including pattern matching, narrative analysis, visual mapping, and word quantification. Narrative analysis detailed the entrepreneurial journey chronologically providing a context to the chosen actions (Golden-Biddell and Locke, 1997). This activity helped to situate the overall narrative in terms of the influence of previous experience of commercialization and/or of interactions with the TTO. Visual mapping allowed us to link the raw empirical material with abstract conceptualizations (Pozzebon and Pinsonneault, 2005) which enhanced our study theoretical background by extending the subcategories of the two theories identified and adding more categories. The word quantification combined with the narrative strategy helped us to prioritize the entrepreneurs' rationales and identify patterns (Maxwell, 2010). Quantification was based on word count (i.e., numerical data) and complemented the analysis and cross-case analysis processes. Quantitative integration or "quantitizing" described by Tashakkori and Teddlie (1998) enhances pattern recognition and increases the robustness of the qualitative results. Thus, this process of enhancing qualitative richness with quantitative clarity is aligned to increasing academic endorsement of incorporating numerical data in qualitative research (Maxwell, 2010; Olson, 2000; Sandelowski, 2001).

To minimize researcher bias, we adopted the structured analysis approach described in Yin (1989). The case study database consists of interview notes, summary findings tables, and verbatim interview transcriptions which guided both the within-case and cross-case analyses. These comprehensive data facilitated thorough review and comparison across cases. Thematic content analysis of the interviews was undertaken using QDA Miner software (v.4.1.21) complemented by double coding by the two researchers to ensure reliability (Miles and Huberman, 1994). The data analysis follows Miles and Huberman's (1994) interactive model which includes data reduction, data display, and conclusion/verification. The final thematic dictionary consists of 2 categories linked to the two theories, 9 subcategories, and 96 codes.

## 4. Results

Our analysis of TTO bypassing by academic entrepreneurs who had bypassed their TTO at least once resulted in three findings or themes: bypass paths, academic entrepreneur bypass context, and reasons and motivations for bypassing the TTO. Each of these themes is discussed below.

### 4.1. Bypass paths

The different means used to bypass the TTO is an important aspect of academic entrepreneurship. Based on our five cases, we identified four different paths linked to different levels of awareness and intentionality adopted by academic entrepreneurs:

**Unintentional Non-Compliance: "Navigating in Uncertainty."** This category includes academic entrepreneurs who bypassed the TTO inadvertently due to unclear understanding of the university's policy. For instance, case A expressed uncertainty about the legalities of invention ownership, stating, "I don't know legally if they own that invention or whether I do." Although initially case A had approached the TTO, the lack of clarity about ownership led to the invention being commercialized independently.

**Passive Compliance: "Exercising Perceived Rights."** In this case the academic entrepreneurs understood the role of the TTO but chose to proceed without its involvement, believing this was allowed. Case C stated that "I was transparent, I met [the TTO], they offered to help [for the commercialization] and [he]I preferred to manage it [without them]." This was a conscious choice with no intention to violate any rules.

**Calculated Risk-Taking: "Conscious Rule-Bending."** This refers to an admitted awareness of the rules but a choice to assume the risks related to their being flouted. For example, Case E had commercialized the invention independently which led to conflict over shared ownership and subsequent legal complexities. This was a deliberate choice to break the rules in full knowledge of the potential repercussions.

**Tactical Avoidance: "Strategic Rule Navigation."** The most sophisticated category involves entrepreneurs who bent the rules to their advantage. In some universities the TTO has the right to commercialize academic inventions but can decide not to enforce these rights if the invention is seen as having limited potential value. Case B employed strategies to make the technologies appear unappealing to the TTO, stating, "technically on paper I am breaking the collective agreement, but we had a handshake that says I am not, so that is very precarious for me." This approach combines compliance and strategic manipulation.

The initial findings add to the literature on TTO bypassing by academic entrepreneurs and offer a more nuanced understanding of this phenomenon. In line with Huyghe et al. (2016) who discuss the issue of TTO awareness, the first bypass path suggests that TTO bypassing might be an inadvertent action. However, our research provides additional insights that challenge these results. While Huyghe et al. (2016) suggest that lack of awareness of the TTO's existence might lead to TTO bypassing, our findings indicate that while the academic entrepreneur might be aware of the existence of the TTO he or she might decide to bypass it due to a limited understanding of the institutional rules related to IP ownership and other obligations. This inadvertent bypassing suggests a critical gap in institutional support and communication. Moreover, while a few studies acknowledged the occurrence of intentional TTO bypassing, our research differentiates between various types of intentional bypassing. For instance, in response to Balven et al. (2018) who theorized about creative ways to circumvent formal academic technology transfer processes, our initial findings identify three distinct types of intentional bypassing: (1) *Passive Compliance* which means the academic entrepreneur consciously decides to legally bypass the TTO and forego its services, (2) *Calculated Risk-Taking* which refers to the decision to knowingly violate the rules being fully aware of the potential risks, and (3) *Tactical Avoidance* which refers to strategic bending of the rules to minimize the commercialization risks while being uncertain about the outcome. These nuanced descriptions of TTO bypassing behaviors provide the foundations for our first theoretical proposition:

**Proposition 1**. Academic entrepreneurs' TTO bypassing paths can be conceptualized according to awareness and intentionality: 1) unintentional non-compliance, 2) passive compliance, 3) calculated risk-taking, and 4) tactical avoidance.

### 4.2. Four TTO bypassing contexts

We explored the contexts of TTO bypassing and identified four overlapping situations that encompass the various contexts behind this choice and provide insights into the thought processes and experiences underlying the decision.

**Confidence in Personal Expertise: "Relying on Self-Sufficiency."** This category includes academic entrepreneurs who are confident and self-reliant and believe that their personal ability and level of industry knowledge outweigh any expertise that the TTO could offer. For instance, Case C's belief in the ability to manage independently ("I thought I could manage on my own") and Case D's emphasis on personal industry experience ("I probably know more than they do"). Case E while acknowledging some personal issues, was still doubtful about the TTO's capacity to compensate for these deficiencies ("I know that I also have some deficiencies [but] I don't think that the TTO is going to fill those holes").

**Deterred by Previous Negative Experience of the TTO: "Influenced by Past Disappointment."** Previous negative interactions with the TTO have a significant impact on the decision to bypass the TTO. For example, Case E's decision to commercialize the technology independently stemmed from disappointing experience of interaction with the TTO ("I have learned a lot about the motivations of TTOs, and I don't like what I have learned"). Similarly, Case A was frustrated by the TTO's intermediation ("preventing the inventor to access the investors directly "), and Case E was critical of operational inefficiencies which led to disillusion and bypassing ("when you look back, you realize what a waste of time to work with the TTO").

**Influence of Colleagues' Negative TTO Experiences: "Peer-Influenced Skepticism."** The influence of colleagues' negative experience of TTO engagement matters: for instance, Case B's decision was influenced by international peers' adverse encounters with TTOs and reflects the perceptions of the academic community more broadly ("I really didn't want to involve [the TTO] because of all of my colleagues' experience of […] doing similar types of […] development"). This skepticism, based on shared narratives, underscores the weight of a common experience in shaping individual choices ("I have a lot of colleagues all over the world, Europe and North America primarily, who have had very bad experiences [as] our IP agreements are very similar").

**Shaped by External Partners' Difficulties with TTOs: "Attuned to Collaborators' Challenges."** Academic entrepreneurs are also affected by external partners' (investors, industry collaborators) experience with TTOs. Case C pointed to the reluctance of investors to negotiate with universities due to concerns about losing control over IP and problems related to university bureaucracy ("I often heard the investors saying that it doesn't make sense, you can't negotiate with universities").

These characteristics related to our 5 cases of academic entrepreneurs who had bypassed their TTO offer a more subtle understanding of the diverse and complex overlapping contexts that drive academic entrepreneurs to bypass their TTOs. These include the influence of individual agency, prior interactions, prevailing narratives, and external market dynamics. These findings support research on academic entrepreneurship which highlights self-confidence as a critical psychological trait for researchers embarking on entrepreneurial ventures (Garaika et al., 2019; Sabir et al., 2019; Zhang et al., 2021). Similarly, prior entrepreneurial experience which tends to indicate accumulated knowledge and learning opportunities is widely recognized as significant for successful commercialization of academic research (Parmentola and Ferretti, 2018; Xia et al., 2018). Moreover, academic entrepreneurs frequently engage in vicarious learning (acquisition of knowledge from peers' experiences) which has a strong influence on their entrepreneurial journeys (Baroncelli and Landoni, 2019; Miner et al., 2012). Finally, social capital and particularly relationships with industry partners, is cited repeatedly as an important driver of entrepreneurial intent and action (Benghozi and Salvador, 2014; Schaeffer et al., 2020). However, while these characteristics have been studied predominantly as antecedents of academic entrepreneurship, our findings show that they are also relevant in the context of decision-making about TTO bypassing. This leads to our second theoretical proposition:

**Proposition 2**. The academic entrepreneur's decision to bypass the TTO is driven primarily by four aspects: personal confidence, previous negative experience of working with the TTO, peer skepticism, and negative experience of external partners.

### 4.3. Why bypass the TTO?

In this section, we examine the reasons why academic entrepreneurs bypass their TTO in line with the principles of TCT and TJM. Understanding academic entrepreneurs' motivations is essential to understand how they weigh the economic logics and ethical considerations when deciding to circumvent the TTO. This duality between economic and ethical motivations underscores the complexity of TTO bypassing and the need for a more subtle understanding of entrepreneur actions by academic institutions.

#### 4.3.1. TCT-related reasons

First, the analysis reveals that academic entrepreneurs who bypass their TTO in their commercialization activities are motivated by perceived systemic inefficiencies and market issues related to TTOs.

**Lack of Understanding about the Technology and Continuity Issues.** Entrepreneurs A, D, and E perceived their TTO as lacking specialized knowledge which was likely to reduce commercialization effectiveness. Case D's view that TTO members "know little [about my domain]" and "would probably not understand [the invention]"and Case E's comment that the TTO "did an evaluation [of the invention] and […] came up with some really ridiculously high valuation" are examples of such issues. The entrepreneurs also claimed that the often-limited resources and expertise in TTOs "hindered their ability to effectively support a wide range of technologies and industries." These problems were exacerbated by frequent personnel changes in TTOs which

required the entrepreneurs to re-explain their projects. For instance, Case A explains that that the "next thing you know somebody else is in the chair [and] you've got to re-explain it again." Frequent TTO staff changes and a poor understanding of the research projects led to the need for repeated explanations and continuous forging of connections which was perceived as inefficient and time-wasting for the entrepreneurs. In terms of TCT, while the lack of specialized knowledge is a concern related to asset specificity, the lack of understanding by the TTO staff indicates perceived cognitive limitation (bounded rationality).

**Perceived Inefficiency in IP Securitization**. The complex legal and bureaucratic TTO processes noted by Cases A, B, D, and E can be daunting and slow, and can push the entrepreneur to seek a faster alternative path. The perceived lengthy and bureaucratic patent filing process coupled with concerns about the TTO's legal expertise reinforce this decision. For instance, Case E recalled that the TTO "did not actually engage a patent attorney to file a patent, they only took someone who had limited experience within the staff […]." Other entrepreneurs had decided that the patent application process would be handled more efficiently in a private setting. Case A stated that "if it had been a private company [it would have been done] four times faster, maybe five times faster." Finally, while the TTO was supposed to share the financial risks and responsibilities related to patent filing, Case D claimed that TTO was not "going to pay for the patents, so why would I want them?" Entrepreneurs who managed their own patent applications were skeptical about the TTOs' efficiency and understanding. In a TCT framework, the perceived slow and complex bureaucratic processes contributed to uncertainty about timely and effective securitization of IP. The complexity and perceived inefficiency of these processes may also stem from the bounded rationality of the TTO.

**Lack of Market Understanding and Inefficient Market Approaches.** Cases A, D, and E referred to perception of poor market insight and ineffective TTO marketing strategies which reduced their confidence that the TTO would achieve effective commercialization of the invention. The entrepreneurs referred to perceived inadequate sales strategies. Case A stated that some TTO staff were "placing phone calls [but] they were not technically strong enough, I think, to make a good sales pitch," while Case E said that the TTO "only [used] a letter-writing campaign, over and over again." These perceived inefficiencies encouraged the entrepreneurs to do their own marketing and depend on their superior understanding of the projects. From a TCT perspective, the perceived ineffective market insights and marketing strategies reflect a perception of limited processing and utilization of relevant market information which indicates a bounded rationality issue. The perception of ineffective marketing strategies increase uncertainty about the TTO's ability to commercialize the invention successfully.

**Lack of Industry and Private Contacts**. The perceived lack of networking capabilities within TTOs observed by Cases A, C, D, and E led the entrepreneurs to rely on their own networks. Case E said that while the TTO "might do some sort of general market research […] they actually don't have any contacts in this respect […] to try to find licensees." Similarly, Case E used "a benchmark email [to] send out 15,000 messages to people who are on my mailing list... why shouldn't I do it that way?" This preference for self-reliance stems from the belief that direct engagement with potential partners is more effective and the TTO's intermediation in negotiations with companies made the entrepreneurs feel they were being sidelined. Case A said that: "I never really, directly spoke to the companies [and] I was never involved directly with the company." This lack of direct involvement led to a feeling that the TTO was not able to represent the level of the entrepreneur's expertise. Cases C and D also expressed frustration over TTO staff who as negotiators were perceived to be overly aggressive or inflexible in their negotiations with private partners over IP agreements, and this was considered a barrier to potential commercialization opportunities. In a TCT framework, perceived lack of networking capabilities within the TTO increased uncertainty about successful commercialization.

**Financial Disincentives**. Perception of limited financial benefit and inefficient financial management by TTOs noted by Cases A, B, D, and E, discourage collaboration. The entrepreneurs perceived that the TTO did not share expenses fairly and demanded a significant share of resulting revenue which increased the academic entrepreneur's costs. Entrepreneurs D and E also considered that TTOs' financial management was weak and expressed concerns about how revenue and expenses were handled and the extent of TTO expenditure which reduced the net revenue from commercialization. Finally, entrepreneurs were unhappy with TTOs' financial arrangements for the distribution of royalties and revenues in particular, and did not believe that involvement of the TTO in commercialization increased profits. As Case A said, after the revenue was split among the various stakeholders this "does not leave very much for the inventor." In a TCT perspective, the academic entrepreneur has a perception of opportunism by the TTO based on its prioritization of its own/university financial interests over those of the entrepreneur. Also, inefficient financial management contributes to uncertainty about potential returns and questions about whether using the TTO is worth the related financial risks.

While numerous studies have examined TTO characteristics such as staff size and budget (Baglieri et al., 2018; Bolzani et al., 2021), our findings highlight a perception among academic entrepreneurs of the limited resources of TTOs. Specifically, the entrepreneurs assessed the fit/complementarity between of TTO staff expertise and the demands of specific entrepreneurial projects. Although the importance of TTOs in academic entrepreneurship is generally acknowledged in the literature (Waldman et al., 2022), the entrepreneurs in our sample believed that the specialist knowledge within the TTO did not always complement the unique characteristics of the inventions and they were doubtful about the ability of TTOs to effectively commercialize these innovations. These findings are in line with an emerging literature which emphasizes the need for a diverse mix of employee capabilities for successful commercialization activity (Soares and Torkomian, 2021). Viewed through a TCT lens, the academic entrepreneur's decision to bypass the TTO can be seen as a rational choice, driven by the perception of a misalignment between TTO capabilities and entrepreneurs' needs. This perception is compounded by doubts about the usefulness of certain TTO services such as IP securitization (Gianiodis et al., 2016) and the TTO's intermediary role (Kienbaum., 2006). Our findings contribute by underscoring the significant role of perceptions in prompting academic entrepreneurs to circumvent the TTO. Additionally, while previous studies have suggested that revenue-sharing arrangements between the university and the entrepreneur can be a disincentive for research commercialization (Halilem et al., 2017), our findings suggest that these arrangements may encourage entrepreneurs to bypass the TTO at the risk even of potential legal disputes with the university. These insights lead us to propose the following propositions:

**Proposition 3**. Academic entrepreneurs are more likely to bypass TTOs when there are gaps in the TTO's technological understanding combined with staff turnover which hinder long-term project management and increase transaction costs.

**Proposition 4**. Perceived inefficiency and complexity of TTO IP securitization processes increase the likelihood the entrepreneur will choose an alternative patent application path.

**Proposition 5**. Perception of weak TTO market strategies and industry networks contribute to the entrepreneur's decision to commercialize the invention independently.

**Proposition 6**. Entrepreneur perceptions of financial disincentives such as unfair revenue distribution and inefficient financial management by TTOs encourage TTO bypassing and use of more advantageous commercialization routes.

#### *4.3.2. TJM-related reasons*

The academic entrepreneur's decision to bypass the TTO is also informed by factors aligned to the TJM and involve considerations such

as cultural incompatibility, resistance to TTO control, and dissatisfaction with legal complexities.

**Cultural Incompatibility among TTO Values.** Cases B and D perceived a misalignment in the value related in particular to technology dissemination and commercialization. This misalignment includes lack of support for specific strategies and failure to understand the entrepreneur's vision. Case B noted that TTO staff "don't understand [that] there is a variety of value interests related to technology dissemination and transfer and commercialization." Case D observed potential bias in TTO staff prioritization of projects. Rather than evaluating projects based on their potential societal benefits, TTO staff seem to prefer projects that are aligned to its vision of technology transfer. Case D told us that "TTO members appear to select certain projects as winners, offering assistance to some while disregarding others [with no regard for the] utility or the market perception." One entrepreneur from our cases had experienced gender bias and perceived that there was a male-dominated culture in TTOs which causes such bias and discourages engagement with the TTO by female entrepreneurs in particular: "the TTO is run entirely by men and [focuses on] engineering […] so it is very much a culture [that discourages] female entrepreneurs from engaging with their TTO." In a TJM framework, the perceived misalignment in the value ascribed to technology dissemination and commercialization is related to the academic inventor's perception of the fairness of TTO decision-making or procedural justice. The different value assigned to these aspects also can work to undermine the perceived legitimacy and authority of the TTO. Finally, gender bias is linked to interpersonal justice in terms of the entrepreneur's perception of fair and respectful treatment from TTO staff.

**Incompatibility with Open-Source Technologies**. The clash between entrepreneurs' preferences for free open-source technologies and the TTO's preference for privatization produced another significant friction described by Case B. Entrepreneurs who prioritize open access over profit from and ownership of the technology found that the TTO vision "does not include open-source[,] sharing [and] creative commons" (Case B). It tends to focus on privatization which may not be compatible with the entrepreneur's vision. Case B also said that the TTO "can force [the inventor] to patent [an invention] even though [the inventor] wants to go open-source" adding that many "colleagues all over the world, Europe and North America primarily, had had very bad experiences of trying to make open source […] technology in the university setting." Thus, entrepreneurs committed to open access and societal impact can find the TTO privatization model counterproductive which encourages them to bypass the TTO to maintain the integrity of their vision. In a TJM context, a preference for open-source rather than the TTO privatization approach can work to undermine the TTO's perceived legitimacy as an authority and suggest distributive injustice and incompatibility with the aim of the academic entrepreneur to serve the broader community. TTOs are also seen as focusing solely on a privatization agenda with no consideration given to other commercialization models which promotes a feeling of unjust procedures.

**Dissatisfaction with TTO Control**. Entrepreneurs C and D expressed concern over the loss of control and the restrictions imposed by TTO rules. The desire for autonomy is especially strong among entrepreneurs who are deeply committed to their industry or technology. For instance, Case D referred to "some real difficulties in getting the TTO to accept that I am the driver of the boat [TTO staff] wanted to own [the invention] and tell me what to do." This concern can be particularly acute in the context of negotiations with external investors or partners. Case C said that private investors were often reluctant to negotiate with TTOs, and recalled that one of the investor's first questions was "do I have the control over the invention?" Case D referred to a similar question from a private investor who asked: "do you have control" and when he responded negatively this "stopped the conversation". Case C told us that, "in the academic world, the famous IP seems like the key, it's not the key at all because […] it completely blocks entrepreneurs, investors who […] absolutely do not want the IP to remain with the researcher [or] in the academic world with the kind of leasing of IP. They hate it!" Consequently, the perception that TTOs are inflexible and overly controlling in terms of ownership and decision-making can discourage entrepreneurs from engaging with them. Through a TJM lens, entrepreneurs' concerns over loss of control and restrictive conditions imposed by the TTO are linked to perceptions of fairness in decision-making (procedural justice). Also, the desire for autonomy and dissatisfaction with TTO control questions the legitimacy of the TTO as an authority.

**Dissatisfaction with Legal Complexity**. The complexity and length of TTO legal documents noted by all five cases create a sense of unpreparedness and vulnerability among entrepreneurs. Case B said that "the [TTO] paperwork is long and it is incomprehensible to me." This unclearness can cause uncertainty and reluctance to engage with the TTO. Case D recalled hiring a lawyer, "who was very experienced in understanding IP policies." He focused on the downsides of such policies and asked me: "why go ahead and spend all this money when you do not have any control over the invention?" Thus, our entrepreneurs found institutional IP policies inflexible particularly in terms of how rights are assigned and managed. Cases A and D told us that TTOs were unwilling to negotiate over terms that were more favorable to or more accommodating of the entrepreneurs' specific needs and circumstances. This complexity led to reluctance to engage with TTOs due to fears about making mistakes in legal negotiations and perception that TTO policies are not entrepreneur friendly. From a TJM perspective, the complexity and length of TTO legal documents affect TTOs' communication of its processes and requirements and is related to informational justice. The complexity involved in TTO legal documents also produces feelings of procedural justice since the entrepreneur perceives lack of transparency unfairness in TTO legal processes.

In line with the TJM, our findings show that academic entrepreneurs often justify their actions as due to unfairness and lack of legitimacy of institutional rules. Universities tend to assume that TTOs and academic inventors have a common objective – to maximize the value of research and enhance its societal impact (Kochenkova et al., 2016; Padilla-Meléndez and Garrido-Moreno, 2012). However, our study suggests that while the entrepreneurs considered that the TTO prioritized privatization when commercializing research and inventions, the individual entrepreneurs favored a range of dissemination strategies which include open-source and reflect a broader understanding of the social utility of their research. The academic entrepreneurs in our sample were keen to retain control over their inventions and perceived or had directly experienced loss of control if the TTO was involved in commercialization. This is in line with studies which show that perceived loss of control can discourage academic inventors from pursuing commercialization through institutional channels (Halilem et al., 2017). Our findings extend this strand of work by highlighting how potential or perceived loss of control not only might discourage engagement with the TTO but also might actively push the academic entrepreneur to bypass the TTO. These insights lead to the following theoretical propositions:

**Proposition 7**. The likelihood that the entrepreneur will bypass the TTO increases with perceived cultural incompatibility including especially potential gender bias and lack of consideration of different strategies.

**Proposition 8**. Entrepreneurs committed to open-source approaches will be more likely to bypass the TTO as the result of a fundamental philosophical clash with the TTO which will tend to favor privatization over open access.

**Proposition 9**. Perceived lack of autonomy and excessive control by the TTO combined with complex and inflexible legal conditions will motivate the academic entrepreneur to bypass the TTO and opt for independent commercialization which is better suited to their aims and reduces legal uncertainties.

#### 4.3.3. A hierarchy of reasons and motivations

Finally, we can offer some more compelling insights from our findings which are based on both qualitative and quantitative research methods. Following Sandelowski (2001), we assume that the motivations/reasons considered most critical by our respondents would be the subject of more and more detailed discussion and thus, a higher word count. While the qualitative analysis reveals the diversity of reasons/motivations linked to the two theories considered, the quantitative analysis allows hierarchical ordering of these reasons/motivations (see Table 4).

The motivations for bypassing TTOs are highly context-specific and reflect the diversity of the issues faced by academic entrepreneurs in different situations. Overall, the reasons and motivations linked to both theories seem to have similar relevance for the respondents (51.5 % of the words used were linked to TCT and 48.4 % to the TJM), indicating that the motivations for TTO bypassing are weighed in terms of transactional efficiency and cultural/legal complexity.

In the context of TCT, the primary concerns were perceived lack of market understanding and inefficient marketing approaches (23.15 % of the words across all cases were related to uncertainty and bounded rationality), financial disincentives (11.88 % of the words were related to uncertainty and opportunism), and perceived lack of industry contacts and difficulties with private partners (10.1 % of the words were related to uncertainty). On the one hand, these results suggest a shared perception among respondents that TTOs do not properly understand and do not effectively target the relevant markets for their technologies. On the other hand, they show that TTOs do not facilitate what could be valuable industry connections and do not offer financially viable options for technology commercialization.

Through a TJM lens, the main motivations for TTO bypassing are dissatisfaction with legal complexity (19.95 % of the words used across all cases were related to procedural and informational justice) and aversion to TTO control (15.56 % of the words were related to procedural justice and authority legitimacy). While these results suggest frustration with the legal intricacies and perception of cumbersome legal processes involved in TTO operations, they also suggest concern about the control exerted by TTOs and a desire for greater autonomy.

Finally, scrutiny of the most frequent individual reasons and motivations identifies three academic entrepreneurship bypassing profiles:

**TCT Motivated Bypassing (Navigating Market Challenges)**: academic entrepreneurs motivated to bypass the TTO for mainly TCT linked reasons i.e., cases A and E (respectively 78.6 % and 72.3 % of their words). This includes entrepreneurs focused primarily on perceived lack of market insight, inefficient industry networking, and weak financial aspects which lead to a preference for alternative commercialization routes.

**TJM Motivated Bypassing (The desire for Autonomy):** academic entrepreneurs who decide to bypass the TTO for mainly TJM-related reasons (e.g., cases B and C respectively 91.2 % and 61 % of their words). This profile includes entrepreneurs driven by issues related to legal frameworks, control, autonomy, alignment to open-source principles and a preference for a system that better matches their values and aims.

**Combined Bypassing Motivations (Dual Dilemma):** academic entrepreneurs motivated by reasons linked to both theories such as Case C (respectively 51.5 % and 48.45 % of words linked to TCT and the TJM). Entrepreneurs in this profile expressed concern over both inefficient market strategies and lack of autonomy.

The final phase of our analysis allows hierarchical ranking of the reasons and motivations for TTO bypassing, and shows that both economic and ethical considerations are crucial. While TCT explains economic motivations for TTO bypassing, it needs to be complemented by an appreciation of the ethical considerations that influence academic entrepreneurs' behaviors. This dual approach allows a more comprehensive explanation of why bypassing occurs; neither theory on its own accounts fully for TTO bypassing. Our theory-based analysis suggests that TTO bypassing can be explained by considering the profiles of academic entrepreneurs who, depending on their individual circumstances, prioritize economic or ethical considerations or a combination of both. These observations lead to our final proposition:

**Proposition 10**. Entrepreneurs who bypass their TTOs are linked to three profiles: 1. mainly influenced by TCT-related reasons (alternatives with better market and financial aspects), 2. mainly guided by TJM related motivations (greater autonomy in principle-aligned environments), and 3. a desire for a better balance between market efficiency and autonomy.

## 5. Discussion and conclusions

### 5.1. Discussion

#### 5.1.1. University/TTO and academic entrepreneurs: Two opposing views?

University and academic entrepreneurs have the common objective of enhancing the utility of their academic inventions and academic research by facilitating the transfer of knowledge and technology from academia to external entities (Halilem, 2010; Perkmann et al., 2013). Within an academic entrepreneurship framework, the transfer of knowledge and technology is aimed at generating societal value and also at creating a revenue stream that benefits both the university and the inventor through the commercialization of research outcomes (Schmitz et al., 2016). While the university is generally viewed as the institutional context within which academic endeavors are managed, university

**Table 4**
Numbers of Words Used by Case and Category of Reasons/Motivations and Theories.

| Theory | TCT | | | | | TJM | | | | Total (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Motivations and reasons | Lack of understanding about the technology and continuity issues | Inefficiency in IP securitization | Lack of market understanding and inefficient marketing approaches | Lack of industry contacts and difficulties with private partners | Financial Disincentives | Cultural Incompatibility of TTO values | An incompatibility with open-source technologies | An advertence for TTO control | Dissatisfaction with Legal Complexity | |
| Case A[a] | 9.10 | 2.46 | 3.44 | 46.34 | 17.27 | 0.00 | 0.00 | 0.00 | 21.40 | 100 |
| Case B[a] | 0.00 | 0.00 | 2.68 | 0.00 | 6.16 | 13.58 | 27.48 | 11.88 | 38.22 | 100 |
| Case C[a] | 0.00 | 0.00 | 0.00 | 52.63 | 0.00 | 0.00 | 0.00 | 47.37 | 0.00 | 100 |
| Case D[a] | 4.14 | 4.32 | 11.13 | 9.53 | 10.04 | 13.40 | 0,00 | 22.65 | 24.78 | 100 |
| Case E[a] | 3.46 | 4.35 | 19.10 | 27.61 | 17.74 | 7.37 | 0,00 | 8.54 | 11.83 | 100 |
| Total %[b] | 3.50 | 2.91 | 10.10 | 23.15 | 11.88 | 8.29 | 4.65 | 15.56 | 19.95 | 100 |
| Total %[b] | 39,66 | | | | 11,88 | 48,45 | | | | 100 |

a Percentages based on number of words in each individual case.
b Percentages based on number of words associated to each category of reasons and motivations/theories across all cases.

scientists tend to be perceived as the primary sources of new technologies and innovations (Halilem et al., 2011; Litan et al., 2007; Padilla-Meléndez and Garrido-Moreno, 2012). Thus, central to academic entrepreneurship is the disclosure of inventions to the TTO which is critical to the transfer of technology (Sapah et al., 2022). However, as the literature review shows, even if invention disclosure is legally mandated a significant portion of IP-based commercial academic knowledge transfer occurs without the involvement of the TTO (Aldridge and Audretsch, 2010; Sellenthin, 2009). Indeed, enforcing invention disclosure is far from straightforward (Markman et al., 2008). The literature shows that while only a minority of scientists is actively engaged in commercialization activities, a significant proportion bypass the university TTO in the transfer of knowledge and inventions. This deviant behavior is due to the incentives for researchers to disclose their inventions and cooperate over developing and bringing the IP to the market. TTOs should be institutional mechanisms which reduce transaction costs by facilitating technology transfer which encourages researchers to disclose their inventions and increase the effectiveness of the technology transfer process (Ustundag et al., 2011). TTOs are also designed to represent the university's interests (Markman et al., 2008), but often operate with a degree of autonomy that allows them to make independent decisions (Boehm and Hogan, 2014).

The findings from our study are consistent with previous results which suggest that academic entrepreneurs' perceptions of TTOs are mixed (Gianiodis et al., 2016; Huyghe et al., 2016) (Secundo et al., 2019; Siegel and Wright, 2015b). Some consider them negatively and do not perceive that they provide the services expected (Boehm and Hogan, 2014). In our sample of academic entrepreneurs, the most frequent concerns raised were related to the perceived inefficiency of the TTO to reduce the uncertainty regarding interactions with private partners, and procedural and informational (in)justices related to the legal complexity and inflexibility of TTO regulations. These findings echo the findings in other studies of skepticism among some academic entrepreneurs about the utility of certain TTO services such as IP securitization (Gianiodis et al., 2016), and the TTO's intermediation in negotiations with third parties (Kienbaum., 2006). Academic entrepreneurs were concerned also about the level of the TTO's knowledge which does not always supplement with the specific expertise regarding their inventions and their commercialization. For instance, our results are in line with the stream of work which suggests that such concerns are greater among scientists with good marketing and negotiating skills, and indicate a potential relation between these competencies and reduced reliance on the TTO (Grimaldi et al., 2011).

On the other hand, several studies highlight the challenges faced by TTO staff and administrators in fulfilling their roles (Kaapo, 2014; Sharma et al., 2006). Although universities often emphasize technology transfer as a means to benefit society (Geiger and Sa, 2008), Bubela and Caulfield (2010) suggest that stakeholders may misinterpret the role of the TTO as primarily revenue-generating, rather than facilitating the creation and transfer of knowledge for the public good. TTO administrators are faced with sometimes conflicting demands (Bubela and Caulfield, 2010; O'kane, C., Mangematin, V., Geoghegan, W., and Fitzgerald, C., 2015). For instance, TTO managers have to navigate gaps in the perceptions of academic entrepreneurs, who view their inventions as viable investments, and venture investors, who may consider them risky and underdeveloped (Fung et al., 2007). The fact that academic inventions tend to be in the early stages of development - the average time between invention and development of a commercial product is around seven years (Banholzer and Vosejpka, 2011) - makes their licensing problematic for TTO managers (Smith, 2011). Additionally, licensing academic inventions often requires finding a balance between maximizing profit—potentially transferring IP to foreign entities—and fostering regional economic development, which may involve retaining IP locally (Bubela and Caulfield, 2010; Tantiyaswasdikul, 2013). Also, several studies highlight that TTOs often operate with limited resources and are required to navigate a wide range of scientific fields (Ruimy, 2017). As a result, they tend to allocate resources to projects with higher potential for returns on investment or projects more aligned to the university's mission (Love, 2015).

Nevertheless, research shows that TTO managers recognize that in some cases, the researcher is best placed to manage the technology transfer process (Boehm and Hogan, 2014). For instance, TTO managers acknowledge that researchers who have well established networks of contacts in industry are often able to manage the transfer of their projects successfully (Boehm and Hogan, 2014). Our results support the findings in Gianiodis et al. (2016) that inventors with existing business community connections will often seek alternative IP and commercialization pathways, foregoing the TTO's services in order to retain more control over and ownership of their work. For example, some of our case entrepreneurs claimed to have more extensive networks than those managed by the TTO and stated also that their individual expertise made them better placed to market their invention. Thus, our findings suggest that academic entrepreneurship policies should consider the diverse aims, motivations, and needs of academic inventors. For instance, while many policies differentiate revenue sharing between universities and researchers based on whether commercialization is managed by the TTO or the entrepreneur (Hen, 2010), the dominant automatic assignment of IP rights still enables universities to retain control over inventions, and to opt out of commercialization if the invention is deemed to have limited potential. Nevertheless, the involvement of academic inventors beyond the disclosure stage remains crucial for successful commercialization (Fung et al., 2007). Thus, our results on the dissatisfaction with TTO control over their inventions, and on TTO bypassing paths indicate that academic entrepreneurs, particularly those with prior experience and established networks, could be less likely to bypass the TTO and are more willing to engage in the commercialization process if they have the opportunity to negotiate ownership and control over their inventions from the initial disclosure.

#### *5.1.2. TCT and the TJM, two faces of the same theoretical coin?*

This study contributes to the theory by drawing on two different theoretical frameworks to study TTO bypassing by academic entrepreneurs. The integration of TCT and the TJM provided a unique lens to examine this phenomenon and revealed aspects which might have remained hidden otherwise.

The TCT framing is particularly useful to reveal the economic and transactional dimensions of TTO bypassing. It highlights how perceived inefficiencies in TTO processes such as uncertainties about market engagement, bounded rationality of TTO staff, and potential for TTO opportunism contribute to the academic entrepreneur's decision to “go it alone.” For example, lack of industry contacts and perceived financial disincentives are critical factors revealed by TCT's focus on minimizing transaction costs and mitigating risks. However, the decision to bypass the TTO can also be motivated by the academic inventor's ethical concerns and perceptions of fairness which are addressed in a TJM framing.

The TJM considers the ethical and justice-related aspects not adequately addressed by TCT f the decision-making about commercialization paths. Dissatisfaction with TTO control, legal complexity, and perceived procedural unfairness are better considered in terms of the TJM's dimensions of procedural justice, distributive justice, and authority legitimacy. These aspects highlight that TTO bypassing is not just a response to economic inefficiencies; it is also a reaction to perceived injustices inherent in the TTO's institutional framework. Entrepreneurs might decide to bypass the TTO to achieve a more efficient transaction but also because they consider the TTO's processes to be unfair, biased, and overly restrictive and to undermine the academic inventor's autonomy and impartiality.

Nevertheless, although our combined TCT and TJM lens provides a better understanding of TTO bypassing, both theories have some limitations in this specific context. For instance, although the complementary quantitative analysis shows that for our respondents the reasons and motivations linked to both theories seem to have almost similar

relevance, some subdimensions such as TCT's concept of asset specificity did not emerge as recurring. This suggests that the lack of specialization in TTOs may be less important than factors such as market uncertainty and financial disincentives. Similarly, we found that the TJM dimension of interpersonal justice which refers to perceptions of respect and fair treatment by TTO staff, was less relevant for our sample which suggests that although fairness is important, it may be outweighed by procedural justice and authority legitimacy concerns.

### 5.2. Contributions

This study makes several contributions. First, it adds to the small stream of qualitative research (e.g., van Burg et al., 2021) based on interviews with TTO directors and department heads, and shifts the focus to the crucial and underexplored academic entrepreneurs who have bypassed their TTO. Based on our interviews, we proposed four categories of TTO bypassing (ranging from unintentional non-compliance to tactical avoidance) which challenge the existing binary compliance-non-compliance views, and suggests behaviors that involve varying levels of awareness and strategic intent. Second, we identified four contexts which seem to encourage TTO bypassing: confidence in personal expertise, previous negative experience, peer-influenced skepticism, and the problems faced by external partners. This multifaceted perspective should enrich the literature on academic entrepreneurship by highlighting the interplay among individual agency, past interactions, community narratives, and external market dynamics. Third, we go beyond an economic framing of TTO bypassing (Goel and Göktepe-Hultén, 2017) by proposing an integrated TCT and TJM framing which is able to capture the economic and ethical reasons and motivations. The 13 theoretical propositions based on these theories provide a more structured understanding of why academic entrepreneurs might choose to bypass the TTO. This theoretical integration could be the cornerstone for a line of research that provides more robust and more comprehensive models of academic entrepreneurship. Finally, the three entrepreneur motivations for bypassing highlight the complexity involved in their decision-making processes.

### 5.3. Implications

Understanding the diverse motivations behind the TTO bypassing of by academic entrepreneurs, particularly in the context of publicly funded research, contributes to a broader discussion on the strategic use of national research and development expenditures (Goel et al., 2023). By examining how various institutional frameworks influence the conversion of inventions into innovations, universities and policymakers can not only enhance the impact of research outcomes but also optimize the efficiency of public R&D investments. This understanding is critical for ensuring that public funds are leveraged effectively to foster innovation and economic growth. Thus, it is crucial to allow university managers and policymakers to develop more responsive and flexible TTO structures. These motivations are influenced by personal expertise, previous experience, peers' experiences, and external partnerships and underscore the need for TTOs to improve their communication, transparency, and flexibility. First, TTOs must understand and align with the diverse needs and expectations of academic entrepreneurs including acknowledgement that different commercialization approaches and open-source technologies have value, and accommodating to the degree of involvement that the researcher would like in the commercialization process. Delving more deeply into and identifying the complementarity between TTO services and academic entrepreneurs' skills and resources would enable more tailored responses to commercialization in terms of both activities/services and ownership and revenue sharing. Incorporating mechanisms allowing regular feedback and adapting policies to evolving entrepreneurial needs would ensure the continued relevance and effectiveness of the TTO. Finally, simplifying TTOs legal structures and formulating more entrepreneur-friendly agreements would incentivize academic inventors' engagement with TTOs.

In terms of the implications for academic entrepreneurs, the findings highlight the importance of building strong relationships with TTO staff and engaging in open dialogue about needs and expectations. Entrepreneurs should proactively seek resources and support from within and outside the university, and wherever possible, negotiate with the TTO. Finally, it is essential that entrepreneurs should understand the TTO's legal and financial rules and the consequences of independent commercialization. In order to achieve successful, sustainable commercialization, entrepreneurs should weigh the long-term advantages (e.g., legal safeguards, network access, financial backing) of partnering with the TTO against their personal entrepreneurial objectives, institutional policies, and market dynamics.

Finally, while in developing countries technology transfer is a recent phenomenon, university patenting activities across Latin America (Soares and Torkomian, 2021), Asia (Zhu and Yang, 2024), and Africa (Mustapha and Ralphs, 2022) have increased markedly. Nevertheless, research shows that the TTOs in these regions are relatively young (Soares and Torkomian, 2021), are sometimes inefficient (Fai et al., 2018), and typically adopt a reactive approach to technology transfer by dealing with entrepreneurial projects on a case-by-case basis (Fai et al., 2018). Isomorphic pressures mean that frequently the developing country universities copy the policies implemented by successful institutions in developed nations (Fai et al., 2018; Zhu and Yang, 2024) which have become normalized and relatively unquestioned (Kenney and Patton, 2011). However, although the examples in advanced countries may provide valuable policy references, we have shown that TTO operations in these countries are far from perfect and are not reducing TTO bypassing. Our study findings suggest that university administrators in developing countries which have certain features in common with Canada, and especially those with predominantly public but decentralized sectors, could learn from our findings. Prioritizing a flexible, responsive TTO structure, simplifying legal processes, enhancing communication, and fostering partnerships are all crucial to ensure involvement of academic inventors. Establishing clear feedback mechanisms, offering educational initiatives, training TTO staff, and providing negotiation support would help to align TTO services with entrepreneurial goals. Additionally, universities should consider and support diverse commercialization pathways and ensure TTOs have the resources necessary to facilitate effective innovation and knowledge transfer.

### 5.4. Limitations

Although our methodology captures TTO bypassing from the perspective of the academic entrepreneur, it has some limitations. First, our relatively small sample size may not fully represent the full spectrum of academic entrepreneurship scenarios. For example, since our sample is predominantly male it may not provide a true reflection of potential gender-based differences in entrepreneurial approaches. However, the sample demographics (in terms of gender, career paths, and age) are in line with the broader academic entrepreneur population (Colyvas et al., 2012; Ding and Choi, 2011) and represent a range of entrepreneurial experience, commercialization modes, and institutional rules profiles. This variety allows a comprehensive view of the TTO bypassing phenomenon and enhances the robustness of our findings. Identifying academics who choose to bypass their TTO is not straightforward due to the clandestine nature of TTO bypassing. Nevertheless, the mix of strategies employed in this study appeared to be effective for achieving saturation. Second, the study relies on self-reported data derived from interviews. While the data are detailed, an interview approach is prone to social desirability bias (Azagra-Caro and Llopis, 2018). Interviewees could inadvertently reshape their narratives to present themselves more favorably thereby affecting data authenticity. However, self-reported data are relevant for understanding the nuances of academic entrepreneurship (Bojko et al., 2021) and have been used in other studies to

explore the behaviors and opinions of academic entrepreneurs (Romero Sanchez et al., 2023). We employed additional strategies to mitigate bias (such as non-suggestive questioning and no pre-access to the interview guide) and found that entrepreneurs willingly shared even potentially unfavorable aspects of their journey (notably regarding flouting of institutional rules). Their candidness lends credibility to their accounts. Third, incorporating quantitative elements within a predominantly qualitative study imposes some limitations regarding especially misuse of numerical data to imply statistical generalization (Maxwell, 2008). In this research, quantitative data were used not for statistical inference but to augment the qualitative analysis, specifically to order the reasons and motivations identified. Among our 10 theoretical propositions, only 1 derives from the quantitative data analysis which suggests a balanced approach.

### 5.5. Future research

Future research should delve deeper into the nuances of TTO bypassing related to academic entrepreneurship. Quantitative studies could statistically validate the identified patterns and explore the prevalence of each bypass path across diverse academic contexts. Also, the spectrum of behaviors from unintentional to tactical avoidance raises questions about ethical considerations and interpretation of institutional rules in academic entrepreneurship. Qualitative research should focus on how academic entrepreneurs perceive the fairness of institutional rules regarding invention ownership and revenue sharing, and the balance between entrepreneurs' preferences for autonomy and perceived TTO control. Finally, while Huyghe et al. (2016) highlight the complexity for academic entrepreneurs of the institutional rules related to invention disclosure and invention ownership, the ambiguity surrounding potential sanctions for TTO bypassing fosters a sense of impunity to bypass the TTO (Gianiodis et al., 2016). Future research could investigate the outcomes of university-inventor litigation which would enrich discourse on the balance between punitive measures and perceived immunity in the transfer of academic inventions.

During the preparation of this work, the author(s) used ChatGPT 4.0 in order to pre-correct-proof the manuscript. After using this tool, the manuscript was then sent for proofreading to a professional service (human). The author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

## CRediT authorship contribution statement

**Norrin Halilem:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Balla Diop:** Writing – review & editing, Methodology, Formal analysis, Data curation.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Norrin Halilem reports a relationship with Government of Canada Social Sciences and Humanities Research Council that includes: funding grants. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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*Appendix: list of contacted universities and characteristics of their TTO*

| Name (in alphabetical order) | Year of creation of the unit | Size of the unit | Budget of the unit C$ 000 | University Total Faculty[1] | Research Income[1] C $ 000 | Patent |
|---|---|---|---|---|---|---|
| Bishop's University | 2000 | 7 | Less than 500 | 114 | 1419 | 0 |
| Brandon University | 1998 | 1 | Less than 500 | 156 | 3141 | 2 |
| British Columbia Institute of Technology | 2005 | 7 | From 1000 to 5000 | 153 | – | 2 |
| Calgary (University of) | 1989 | 30 | More than 5000 | 1611 | 254,179 | 25 |
| Cape Breton University | 1990 | 7 | Less than 500 | 114 | 3523 | 1 |
| Fraser Valley (University of) | 1974 | 7 | More than 5000 | 640 | 1351 | 0 |
| Guelph (University of) | 1985 | 7 | From 500 to 1000 | 750 | 132,947 | 20 |
| HEC | 1996 | 14 | More than 5000 | 308 | 12,584 | 0 |
| Laval University | 1987 | 9 | From 1000 to 5000 | 1329 | 268,313 | 60 |
| Lethbridge (University of) | 1967 | 4 | More than 5000 | 414 | 13,663 | 7 |
| McGill University | 1994 | 21 | From 1000 to 5000 | 1665 | 375,739 | 66 |
| Memorial University | 1987 | 15 | From 1000 to 5000 | 870 | 75,674 | 15 |
| Mount Allison University | 1998 | 1 | Less than 500 | 141 | 2631 | 0 |
| New Brunswick (University of) | 1999 | 5 | From 500 to 1000 | 561 | 46,591 | 33 |
| Nipissing University | 1992 | 7 | More than 5000 | 144 | 2219 | 0 |
| NSCAD University | 2005 | 7 | From 1000 to 5000 | 42 | – | 0 |
| Ontario Institute of Technology (University of) | 2002 | 9 | More than 5000 | 99 | 6086 | 1 |
| Ottawa University | 2002 | 10 | From 1000 to 5000 | 1197 | 229,035 | 80 |
| Polytechnique de Montréal | 1997 | 17 | More than 5000 | 245 | – | 15 |
| Queen's University | 1994 | 25 | From 1000 to 5000 | 804 | 212,000 | 0 |
| Regina (University of) | 2002 | 4 | From 500 to 1000 | 426 | 21,134 | 28 |
| Saint Mary's University | 2005 | 2 | Less than 500 | 234 | 9775 | 0 |
| Saskatchewan (University of) | 2001 | 10 | From 1000 to 5000 | 1014 | 150,507 | 20 |
| St. Francis Xavier University | 2001 | 1 | Less than 500 | 246 | 11,679 | 0 |
| St. Thomas University | 1999 | 4 | From 1000 to 5000 | 108 | 750 | 0 |
| Université de Montreal | 2001 | 22 | From 1000 to 5000 | 1863 | 356,629 | 30 |

(*continued on next page*)

(*continued*)

| Name (in alphabetical order) | Year of creation of the unit | Size of the unit | Budget of the unit C$ 000 | University Total Faculty[1] | Research Income[1] C $ 000 | Patent |
|---|---|---|---|---|---|---|
| Université de Sherbrooke | 1986 | 13 | More than 5000 | 936 | 86,172 | 21 |
| Université du Québec en Abitibi-Témiscamingue | 1983 | 6 | Less than 500 | 105 | 10,249 | 1 |
| Université du Québec à Montréal | 1989 | 6 | From 500 to 1000 | 930 | 62,361 | 0 |
| Waterloo (University of) | 1992 | 12 | From 1000 to 5000 | 1002 | 121,304 | 20 |
| Western Ontario (University of) | 1995 | 15 | More than 5000 | 1446 | 237,943 | 27 |
| Wilfrid Laurier University | 2000 | 1 | Less than 500 | 474 | 9437 | 0 |
| Winnipeg (University of) | 1967 | 7 | From 500 to 1000 | 285 | 4527 | 0 |
| York University | 2002 | 4 | Less than 500 | 1455 | 62,294 | 0 |

[1] Data for Total Faculty and Research Income retrieved from the (Canadian Association of University Teachers, 2010) Total Faculty includes all faculty with no senior administrative duties (tenured, tenure track, etc.), Research income includes all funds received to support research (grants, contracts with all sources external to the institution).

## Data availability

The data that has been used is confidential.

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