JoRMA
JOURNAL OF RESEARCH MANAGEMENT AND ADMINISTRATION

CONTEXT-DEPENDENT CRIMINALIZATION OF ACTS OF RESEARCH MISCONDUCT – BYPASSING THE FFP DEMARCATION PROBLEM WITH A TWO-TIER ACADEMIC AND CRIMINAL-LEGAL INVESTIGATIONAL STRUCTURE

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ABSTRACT

What is new?	A prominent issue that hampers criminalization of scientific or research misconduct (RM) is the criminal demarcation problem. Criminalization is often deemed to be applicable to widely adopted core RM acts of fabrication, falsification and plagiarism (FFP). However, it has been argued that this FFP limit or demarcation might be unwieldy, being potentially either under-inclusive or overly exclusive.
What was the approach?	Here, I suggest that constructing technical boundaries for RM criminalization is neither critical nor useful. The criminal nature of an act of RM would be better defined by its intent, imposed risk, consequences, severity of harm to others, as well as whether it violates prevailing laws. Albeit small in number, perpetrators of egregious acts of RM, both within the FFP realm or otherwise, have indeed been punished by the state. Criminalizing egregious acts of RM is within the current academic and legal capacity of most research-active nations and can be facilitated by a proposed dual or two-tier academic and criminal-legal investigational structure.
What is the academic impact?	In close communication and collaboration with academia that would provide domain expertise to navigate the technical intricacies of a case of RM, the legal system can then seamlessly and effectively institute follow-up criminal prosecutions if and when appropriate. This two-tier

	academic and criminal-legal investigational structure would enhance investigational coverage and efficacy.
What is the wider impact?	The two-tier academic and criminal-legal investigational framework might also be applicable to other forms of misdemeanour or fraud by those within the academia.
Keywords	Criminalization, Research misconduct, Fabrication, falsification and plagiarism (FFP).

INTRODUCTION

Misconduct in scientific research (or research misconduct, RM) are dishonest acts committed during the processes of research from funding acquisition to publishing research results. Although a range of dishonest acts and deviations from best practices in scientific research appears to form a spectrum of misbehaviour (Bouter, 2023), RM is conventionally defined as acts of fabrication, falsification and plagiarism (often abbreviated as the FFP) (US Office of Research Integrity, 2022). On the other hand, acts that deviate from the best practices of research but are not FFP in nature are often classified under questionable research practices (QRP) (Andrade, 2021). More generalizable acts of deceit and harm that occur in other vocations or professional settings, such as misuse of funding and harassment, might also be viewed as RM when these occur within a research setting (Frazier, 2019). Furthermore, other misbehaviours in research such as duplicate publications, fake-peer review and failure to disclose conflict of interest are also included as RM in codes, policies, and professional documents (Dal-Ré & Marušić, 2025). Both the malpractices of RM and QRP are apparently widespread (de Vrieze, 2021; Xie et al., 2021), and damages incurred by such to the research enterprise, community, culture as well as the lay public cannot be underestimated or ignored.

With the increase in the reporting of incidence and cases of RM and the occurrence of particularly egregious cases, it appears that some application of retributive justice (Walen, 2023) would be in order. It has been proposed that research fraud should have the same legal liability as torts (Guerra-Pujol, 2015). A number of authors have further argued that severe misconduct in scientific research should be made criminally liable and that principles and processes of jurisprudence should be applied to sanction RM and to promote integrity (Kuzma, 1992; Adams & Pimple. 2005; Sovacool. 2005; Redman & Caplan, 2005; Candlish, 2008; Nature editor, 2013; Smith, 2013; Nuwer, 2014; Freckelton, 2014; Redman & Caplan, 2015; Faria, 2018a). On the other hand, there are also dissenting voices against RM criminalization (McCook, 2006; Bhutta & Crane, 2014; Collier, 2015). An important issue in RM criminalization that has been more recently expounded by Bülow and Helgesson (2019) and reiterated by Dal-Ré and colleagues (Dal-Ré et al., 2020) is the RM demarcation problem. The questions posed boil down to

where the line should be drawn in determining which acts should be criminalized, and which should not.

Here, I revisit the issue of RM criminalization and the demarcation problem. I allude to the fact that criminalization of certain acts of RM has indeed occurred in multiple widely publicized cases. For example, Eric Poehlman falsified 17 NIH grant applications and fabricated data in 10 papers on aging metabolism and obesity, was permanently barred from federal grants and ordered to serve a year and a day in prison (Dahlberg & Mahler, 2006). Woo-Suk Hwang fabricated two papers in Science on human pluripotent stem cell cloning and was indicted on charges of embezzlement and breach of South Korea's bioethics law (Normile, 2009). Steven Eaton, who faked research data for experimental anti-cancer drugs, is the first person in the UK to be jailed under scientific safety laws (Dyer, 2013). Dong-Pyou Han fabricated results to apply for NIH grants in HIV vaccine research, was indicted on four federal felony counts of making false statement and sentenced to 57 months in prison with a hefty fine (Reardon, 2015). Jiankui He was imprisoned for his illicit work on human genome editing (Normile, 2019). Theranos CEO Elizabeth Holmes was convicted of fraud and conspiracy and sentenced to 11 years of imprisonment (Dyer, 2022). Paulo Macchiarini was convicted of causing bodily harm to patients and sentenced to prison for 2.5 years by a Swedish court (Paterlini, 2022; Vogel, 2023).

As such, I posit that criminalization of acts in RM should not be constrained by the technical nature of the act (i.e. whether it falls under FFP or otherwise), but rather based on its inherent moral infringements in terms of intent, risk, consequence and severity. Further, I propose a two-tier investigative platform for interrogating acts of RM such that these receive adequate technical scrutiny and fitting sanctions by the law.

Should Research Misconduct be Criminalized?

In her book entitled "Research misconduct as white-collar crime" (Faria, 2018b), Rita Faria has proposed that RM be treated as a subject in criminology, arguing that the latter "is especially well prepared, from a theoretical, conceptual, and methodological point of view, to produce empirical knowledge about the topic, and to sustain theories about its causes, processes, and harms, as well as about the formal and informal social reaction to it" (Faria, 2018a). In view of the potential direct harm caused by some egregious acts of RM to research participants, patients and the public, as well as damage to public trust in science, all of which infringe upon societal and national interest, simply exposing these misdeeds would appear to be insufficient. Sanction-based interventions by the state (i.e. the prosecution and the judiciary) might be warranted (Nature editor, 2013).

A main argument for RM criminalization is that it would serve as an effective deterrent and to facilitate neutral and effective investigation. As Benjamin Sovacool (2005) puts it, "Providing stricter criminal statutes against misconduct is necessary to motivate whistleblowers and deter wrongdoers, and the provision of basic due process protections is necessary for ensuring a fair and balanced misconduct investigation" (p.

W1). Given that scientific research is costly and dependent on public money, Barbara Redman and Arthur Caplan (2005) have posited that "The standards by which science is judged should not be an exception to those governing others who deal with the public's money and have a duty to the public interest" (p. 345) and that "that criminal sanctions for the most egregious cases might sufficiently raise the stakes to serve as a deterrent…" (p. 348). These views were also shared by several other authors (Smith, 2013; Bhutta & Crane, 2014; Collier, 2015).

On the other hand, there are ample oppositions against the idea of RM criminalization. In her writings, Alison McCook has quoted Scott Burris' comment that prosecuting fraud could have a "chilling effect" on science, in that "seeing their colleagues facing criminal charges may cause some honest researchers to shy away from studying unpopular or controversial areas, fearing a mistake could land them in jail …" (McCook, 2006). Julian Crane has gone as far as stating that criminalizing research misconduct is a "sad, bad, even mad idea" which would undermine trust in research (Bhutta & Crane, 2014). In proposing to adopt a jurisprudence platform for scientific misconduct for the Netherlands, Siegerink and colleagues have nonetheless pointed out that it is undesirable for the handling of scientific integrity to be drawn towards the legal field (Siegerink et al., 2024). That the academic community is somewhat divided on this issue could be gleaned from a more recent survey conducted with Polish academics, with about half wanting fabrication and falsification criminalized (Skarbek, 2024).

The pros and cons of RM criminalization aside, there exists another technical issue of how the margins should be drawn when it comes to the criminalizable acts in RM. Given that FFP are core acts of RM, should these acts, perhaps above all others, be criminalized?

FFP and the RM Criminality Demarcation Problem

Bülow and Helgesson (2019) have previously made an important point against the claim that FFP represents the most serious forms of misconduct that ought to be criminalized. According to the authors, "… given a tentative moral justification for criminalizing research fraud and scientific misconduct, a law targeting only or primarily fabrication, falsification and plagiarism is both too inclusive and too exclusive; that is, it would include acts that arguably should not be criminalized and exclude behaviour that arguably should be …", and as such, "… the question therefore remains how to decide what ought to be considered serious enough, and what should not" (Bülow & Helgesson, 2019). This is an apparent issue because there are acts that fall within the FFP definition but are clearly not severe enough to warrant criminal investigation/prosecution (which might well include a good majority of the RM cases), and to proceed as such would not only be a waste of resources but would unfairly stress the parties concerned. On the other hand, there is a danger that acts that are non-FFP in nature would have their liabilities underdetermined, thus excusing or even

passively encouraging such acts. As the demarcation of criminality is unclear in RM, corresponding legislation could not be precisely formulated.

However, RM criminality demarcation would not really pose a real problem for criminalization of acts of RM for two reasons. The first pertains to the fact that a number of real-world examples of perpetrators of severe or egregious acts of RM have indeed been convicted and punished by the law (including fines and incarceration) in different countries. Importantly, these include acts that are both FFP and non-FFP in nature. Prominent examples of the former include the Poehlman case (Dahlberg & Mahler, 2006), the Hwang case (Normile, 2009), the Eaton case (Dyer, 2013) and the Han case (Reardon, 2015), and the latter would include the Jiankui He case (Normile, 2019), the Theranos case (Dyer, 2022) and the Macchiarini case (Paterlini, 2022; Vogel, 2023). While there is clear evidence that Jiankui He's "CRISPR babies" experiments did not receive appropriate ethics approval (if any) and as such is a case of RM, He has not published a peer-review paper on the work and the FFP definition would therefore hardly apply. The charges on Holmes stemmed from RM but publications on Theranos' analytical technology is scarce and there is no clear evidence of FFP simply because a majority of the company's data were not subjected to external scrutiny or peer review. Paulo Macchiarini's criminal conviction of causing bodily harm to patients and prison sentences are separate from the RM issues in his retracted papers. Perpetrators' institutions have also been subjected to fines, perhaps the most prominent being the recent case associated with Erin Potts-Kant (Martin, 2019; Casadevall, 2019).

The second reason is that neither FFP nor any categorization of RM provide adequate boundaries for criminalization, and defining such boundaries might not even be critical or necessary for criminalization. I posit instead that criminalization or otherwise of an RM case should be dependent on the intents, risks imposed by, the consequences of the acts, the severity of the consequences, as well as at the first instance whether these acts a) violate prevailing laws and b) fulfil the elements of a crime. These points are further elaborated below.

Determining if RM is Criminalizable Based on Intents, Risks, Consequences, Severity and the Prevailing Laws

Two of the most important elements that determine the severity of RM are "intent" and "consequences" (Yeo-Teh & Tang, 2022). A specific determination of intent (Yeo-Teh & Tang, 2025) by a preponderance of evidence would make a finding of RM definitive (Thaler & Simon, 2021). Cases of RM with clearly discernible malignant intent to harm others would be rather rare, but if one is identified as such, its criminal nature would hardly be in doubt. On the other hand, "consequence" indicates the severity of the fallout or aftermath of RM in terms of harm caused to others. In the latter regard, it would be particularly useful to consider Toshio Kuroki's classification of RM (Kuroki, 2018). Kuroki has divided RM acts into three classes. Accordingly, fabrication and falsification represent "betrayals of truth" and are considered class I misconduct. Plagiarism, irreproducibility, as well as inadequate research practices "betray trust" and

are grouped as class II RM. Acts that pose risks to safety and health and industrial products come under class III RM. Kuroki's RM classification thus takes into consideration risks and consequences other than the technically fraudulent nature of the acts on their own (Kuroki, 2018).

Similar Acts, But with Differing Intent, Risks, Consequences and Severity

Acts in RM might be similar in scientific or technical nature, but could have different impact on participants, patients and the public. This point can be illustrated by the following paired comparative examples. In the first example, a researcher who had recklessly falsified data on the effect of suppressing a gene in wing development of the fruit fly would be similar in scientific or technical nature to another who had recklessly falsified data on the effect of suppressing the same gene orthologue in human anti-cancer therapy. However, the latter act could bring harm to clinical trial participants and patients. While both are unquestionably acts of RM, the latter, or more precisely its associated (or projected) risks and consequences, is criminal in nature.

In the second case, a researcher falsifying/fabricating images in a school poster presentation would pose a different level of risks and consequences from another falsifying/fabricating the same set of images in a federal grant application. Again, both acts are similar in their FFP nature and are undoubtedly acts of RM. However, the latter would be more severe in its context as an attempt to defraud public money, and might be deemed a criminal offence by most, if not all, judiciary systems. From these examples, misconduct severity stemming from an intent to defraud and resulting from the act's risks and consequences should thus be the primary determinant for RM criminalization, rather than the technical nature of the acts.

Both the above example cases are FFP in nature. In the third, non-FFP example pair, a researcher who violates approved psychological data collection protocol when dealing with a group of healthy volunteers and another who worked with a group of patients with manic depression and other mental illness would perceptibly incur different levels of risks and consequences. The potential harm that could be conceivably caused by the exact same acts of violation to the latter group of subjects would be much greater.

In a fourth, non-FFP paired example, a researcher had provided a set of individuals' genomics data under his charge and safekeeping to unconditionally help a researcher "friend" from neighbouring department who was desperate for some training data to round up the latter's PhD thesis, while another researcher had sold a similar set of data to a company for a good sum of money. Again, the acts of research data leakage are similar in their technical nature, but in the latter case the perpetrator's intent to profit from his act and the potential risks and bad consequences incurred on the research subjects would have made the act criminal.

In a final non-FFP paired example, we have on one hand an editor of a predatory journal which claims to conduct peer review with a wholly inadequate process in which

submitted articles are read and commented upon by office staff and interns instead of experts or established researchers in the field. On the other is a guest editor of an established journal who had organized a fake peer review ring that had effectively allowed a group of authors to review each other's submissions (or even their own). While the former should be assiduously avoided by serious researchers, the latter appears to be a far more serious misdemeanour because of the clear intent to deceive the journal and its readers and to corrupt the peer review process with false pretence.

From the paired examples above, it follows that the primary consideration for criminalization should not be prescriptive in terms of whether these are classified under FFP or otherwise. A case-by-case, context-dependent, consideration of case details and their associated intents, risks, consequences and severity would be necessary to determine worthiness for criminalization.

RM AND PUNISHMENT

In their review on the psychology of compensatory and distributive justice, Darley and Pittman stated that "The primary reaction to carelessly inflicted harm is to seek restitution; the offender is judged to owe compensation to the harmed individual. The primary reaction to harm inflicted intentionally is moral outrage producing a desire for retribution; the harm-doer must be punished" (Darley & Pittman, 2003) (p. 324). Retributive justice could thus be broadly understood as relating to the morally deserved, proportionate punishment of those who have committed crime and violate societal rules (Walen 2023). Given that most, if not all research is supported by taxpayers' money, there appears to be little doubt that perpetrators of RM should be held accountable for their misdeeds and punished in some manner for the state's and public's losses in their investment in research.

In citing Herbert Morris' general take on punishment of wrongdoers (Morris, 1968) and Feinberg's argument that punishment must reflect hostility to render it meaningful (Feinberg, 1965), Laura Hansman and Samuel Reis-Dennis termed punishment as " … an effort to restore the social order in the wake of wrongdoing" (Hansman & Reis-Dennis, 2023). In providing a legal perspective on sanctions of RM, Rebecca Dresser has cited the three main types of legal remedies that have influenced sanctions as ones based on restitution, retribution and deterrence (Dresser, 1993). As such, if there is a particular act of RM that is sufficiently severe such that it should be criminalized, the process and outcome should be in line with the nature of these legal remedies. In other words, the risks in harming or harmful consequences of an act of RM could be so bad that some form of legally institutionalized compensation and punishment should be instilled with a primary objective of deterring the recurrence of similar misdeeds, and to uphold retributive justice (Wenzel & Okimoto, 2016). Importantly, details of the case should then clearly indicate violations of prevailing penal codes in the legislature. It is only with the latter should perpetrators be subjected to state prosecution. Finally, in order to prosecute and sustain any conviction in criminal proceedings, the basic elements of crime, namely criminal act (actus reus), criminal intent (mens rea), concurrence (of the

preceding two elements), and causation (act's connection with an injury, loss, or harm), would need to be established.

It is worth noting that in the real-world cases in which perpetrators of RM have been criminally prosecuted, the terms of legal indictment are often only indirectly related to the acts of FFP. While Hwang has clearly fabricated data and images in his retracted papers, he faced charges of fraud, embezzlement, and violations of the country's bioethics law (Wohn & Normile, 2006). Notably, Hwang had claimed to have derived human stem cell clones from individuals, with implications that these might eventually be used in an autologous manner. Had his acts of misconduct remained concealed for a longer period, the latter might have occurred, likely with tragic consequences and a corresponding elevation in criminal severity. Macchiarini had also committed acts of falsification and fabrication in his papers, but his later prison sentence by a Swedish court is for aggravated assault against his patients, victims of his fraudulent stem cells-seeded artificial trachea implant (Vogel, 2023). Jiankui He was sentenced for deliberately violating national biomedical research and medical ethics regulations, by forging ethical review documents and conducted implantation of gene-edited embryos with unknowing colleagues (Normile, 2019). He, however, did not have an FFP-type RM on record as he has failed to get his work on the CRISPR embryos published. In all these cases, criminal proceedings were undertaken in relation to acts of RM, but clearly not directly against the acts themselves. Rather, criminal prosecutions were made against violations of laws associated with, or arising from harm to human subjects, patients and society due to the fraudulent research.

Dual Academic and Criminal Investigations of RM

In many countries and regions, the primary responsibility for investigating research misconduct allegations is placed on the respective respondent's institutions. In the US, misconduct allegations from research sponsored by federal agencies such as the National Science Foundation (NSF) and the National Institutes of Health (NIH) are primarily investigated by grantee institutions, who are responsible for reporting these to NSF's Office of the Inspector General (NSF-OIG) and the Department of Health and Human Services' (HHS's) Office of Research Integrity (ORI) respectively. NSF-OIG can perform inquiries and investigations itself when it chooses to, or when an institution requests that it do so. ORI staff typically assists institutions in their investigations and reviews the resulting reports (Committee on Science Engineering Medicine and Public Policy; Committee on Responsible Science, National Academy of Sciences, 2017). The European Network of Research Integrity Offices (ENRIO) has published a handbook on recommendations for the investigation of research misconduct (2019). The UK Research Integrity Office (UKRIO) (2026) has a similar advisory on "Tips and Ideas" for managing RM investigations (Sainsbury, 2024). Although details vary, institutional investigations of RM typically follow procedures stipulated by institutional research integrity codes of conduct based on the broader federal or confederation governing guidelines. Typically,

a committee of inquiry would be formed to conduct fact-findings, interviews and to draft a report for the institutions' governing authorities. However, there could be great variation in how such committees should be staffed, how investigations should be conducted and how adjudications and/or recommendations could be made (if the latter is even within the purview of the committee).

There are two major issues to consider in terms of investigation of RM. The first is that such investigations often require domain or subject expertise to navigate the technical intricacies of the misconduct, which is more readily available in universities and research institutions. However, domain experts in the sciences may lack know-how in criminological and legal matters. The second is the authority and power to call upon witnesses and to mandate provision of testimonies. This can be a problem with RM investigations conducted within a research institution, for its authority in calling upon witnesses or soliciting testimonies from parties outside the institution (such as collaborators from other institutions or industry partners) would be very limited. As pointed out in their recent editorial in Science, Ivan Oransky and Barbara Redman noted that even authorities such as the US Office of Research Integrity lacks subpoena power (Oransky & Redman, 2024).

A way to address the above obstacles is for allegations of RM to be investigated, primarily and at the first instance, within an academic setting. However, there should be an established channel of communication between the primary investigating party with a state-run unit or office that conducts criminological and legal assessment of such cases. The latter shall scrutinize case details, as they are being revealed by the former, from a criminological perspective and in accordance with the constitution and legislation to identify any violation of the law and shall aid or collaborate on (or if necessary, takes over) investigation when any such violations are uncovered. Importantly, the state unit can and should be empowered with the authority to call upon witnesses from more external parties that are implicated in a case.

There are two main concerns with the practice of institutional investigation of RM. Firstly, it is administratively burdensome and does not align well with an institution's primary academic objectives of education and research, and secondly institutions may not be forthcoming or are inadequate in conducting fair and transparent investigations. As revealed by Dorothy Bishop's recent Delphi survey, there is a significant polarization of views between RM sleuths and institutional research integrity experts on "… the frequency of serious research misconduct, the adequacy of institutional responses, and the suitability of self-regulation by institutions" (Bishop, 2026). Transparency is an issue as institutional internal investigation reports are very often not released for public view (Gunsalus, 2019). Hindrance to a thorough and fair investigation could be particularly serious when RM allegations are made against top university officials (Resnik et al., 2025). In these regards, it would be ideal for RM investigations to be state centralized, such as those already implemented in the case of the Danish Board on Research Misconduct (https://ufm.dk/en/research-and-innovation/councils-and-commissions/The-Danish-Board-on-Research-Misconduct) and the Swedish National

Board for Assessment of Research Misconduct (https://npof.se/en). A centralized authority or federal agency for RM investigation would be deemed a neutral port of call that could attract whistleblowers who are too fearful to report on their own colleagues within the same research institution. Such an agency could also draw academic and technical expertise from different institutions, thus avoiding potential conflicts of interest that are often encountered or suspected when investigations are done internally by colleagues within respondents' institutions. Communication of such a central RM investigative agency with a state unit that conducts criminological and legal assessments would be facilitated and simplified, and in fact the two might be merged into a single entity for simultaneous academic and legal scrutiny of RM cases.

The dual or two-tier investigation approach suggested above would ensure the following: 1) relevant subject domain expertise is available to tackle the scientific intricacies of RM case details; 2) the primary assessment and debates on integrity lie within the hands of scientific committees and not solicitors; and 3) legal violations would not be missed, covered-up or otherwise glossed over. Without having to decide a priori if acts of RM should be designated as a crime, no extensive revisions to current laws would be necessary. There would also be no undue worries that acts that are non-FFP in nature would be underdetermined or ignored. Cases (FFP or otherwise) with a low degree of risks, consequences and severity that are not subjected to legal prosecutions could still be sanctioned by the institutional by-laws, as well as institutional or national codes of research ethics and integrity. As such, all perpetrators would be sanctioned accordingly at the appropriate level. Another added benefit of such a two-tier system is that given that many institutions do not publicize the details of an investigation and its outcome (Gunsalus et al., 2018), the criminal-legal wing of the two-tier system may be obliged to make the details of these egregious cases publicly accessible, thus promoting transparency and trust (Gunsalus 2019).

Concerns and Limitations

Questions could be raised with regard to the proposal above. The first is whether such a two-tier set up would differ significantly from the current state of affairs in most research-active countries and whether it would truly facilitate criminal assessment of egregious acts of RM. After all, research institutions could still be rate-limiting, or tardy and slow in their first responses to cases of RM. In this regard, the state-run RM unit or office would serve as an additional watchdog, in fact one with an overarching reach over all research institutions within a nation, or coalition of nations. Such a reach would be very effective in consolidating information on the ground, which would be effective in detecting RM and its investigation.

Secondly, even if granted that the two-tier framework might improve the coverage of RM investigations and tightening its link to criminal probes, might that not create an ambience of alarm and wariness among researchers, which would negatively impact those hungry for adventurous undertakings and those pushing the frontiers of

innovation? It should, however, be clear that any research, no matter how innovative or groundbreaking in nature, must be conducted responsibly. In this regard, it should be noted that the Responsible Research and Innovation (RRI) principles stipulate that research and technology development should be ethical, sustainable, and aligned with societal values (Owen et al., 2012; UKRI, 2026).

Finally, is the two-tier RM investigative set up unnecessarily taxing, as the staffing of the state-run unit or office would eat into federal money budgeted for research? An estimate published in 2015 on the prevalence of irreproducible preclinical research (more than 50%) estimated a loss of approximately USD 28 billion/year in the US alone (Freedman et al., 2015). Even if only a fraction of this irreproducible research is due to RM, the immense economic burden incurred by fraud in research is significant. The above estimate is only from a finance perspective and has not taken into account other individual and public threats or harms caused by research fraud. Having extra measures to handle and effectively deter RM would thus be a small, yet value for money, investment to make.

Concluding Remarks

In support of the notion that at least the most egregious cases of RM should be criminalized, here I argue that the FFP or other ways of categorizing RM are not helpful in determining whether an act should be criminalized or otherwise. Instead, criminalization should be context-dependent on the intents, risks and consequences of RM, and whether these risks and consequences constitute a violation of prevailing laws, as determined by the proposed two-tier academic-criminal legal scrutiny. This notion side-steps the problem of demarcation and makes provision for the criminalization of only those acts of RM that warrant such proceedings. As such, there would be no danger of unnecessarily instilling the scientific or research community with feelings of unrest and distrust, or inadvertent waste of state resources in prosecuting cases that are contextually non-criminal in nature.

Acknowledgments

The author is grateful to the reviewers, whose insightful comments improved the manuscript.

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A two-tier academic and criminal-legal investigational framework for research misconduct

Accepting Editor: Saiqa Anne Qureshi | Received: 19 February 2026 | Accepted: 30 March 2026
Cite as: Tang, B. L. (2026). Context-Dependent Criminalization of Acts of Research Misconduct – Bypassing the FFP Demarcation Problem with a Two-Tier Academic and Criminal-Legal Investigational Structure. *Journal of Research Management and Administration*, *5*(1), 2026043002.
https://doi.org/10.18552/jorma.v5i1.1429