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SURVEY ARTICLE

A Cross-Sectional Online Survey of Researchers, Project Managers, and Decision-Makers to Assess Factors That Contribute to Complexity and Project Success

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ABSTRACT

Complexity is a major problem for managers and decision-makers and needs to be addressed for projects to succeed. The aim of this study was to explore the factors contributing to complexity and project failure and success. An online cross-sectional survey of 114 researchers, project managers and decision-makers was conducted to explore these factors. Results showed that all participants who use project management indicated that it contributes to the success of their projects. Humans and human interactions were chosen by most participants as the main factor responsible for complexity. Most participants indicated that poor communication and collaboration was the biggest factor preventing them from achieving their goals. Participants mostly prefer working with people that they have a lot in common with, and most indicated that smaller teams of four to five people are better for optimal performance compared with larger team sizes. Feeling valued, respected, and being adequately rewarded motivated participants to perform well. In conclusion, project management may be able to improve the chances of project success. Addressing human factors and interactions may reduce complexity and motivate people to perform well. Limitations of this research include convenience sampling and subjective responses to a cross-sectional survey rather than objective measurement of outcomes.

Keywords: Complexity; Project success; Project management

1 Introduction

Public health is influenced by numerous systems that have an impact on how health and wealth are generated and disseminated, and include local and national level services such as schools, hospitals, communities, policy agencies, and political and economic systems (Haynes *et al.*, 2020). Policies affect cultural, political and social factors and regulations, and have a strong and direct influence on people's health (Chhetri & Zacarias, 2021). Decision-makers often have to deal with wicked problems. A wicked problem is a politically charged problem with many conflicting views and competing interests, which is underscored by information that is lacking or contradictory, and therefore hard to understand and hard to find solutions for (Campbell, 2021). Tight timelines, limited resources, lack of knowledge, infrastructure and difficult relationships make these problems more complex to deal with (Champagne, Gaudreault, & Moira, 2020).

The biggest challenge for leaders and decision-makers across sectors is increasing complexity and its consequences such as uncertainty, volatility, and lack of consensus (Jackson, 2020). Complexity is time and resource intensive, and constantly need tailoring to context (Bicket, Hills, Wilkinson, & Penn, 2021). Complexity can be defined as the relationship and interactions between many actors, parts, or factors that result in dynamic changes in a project (De Toni & Pessot, 2021). Projects are temporary transient organizations, where increasing uncertainty requires collaboration and urgency (Gorod, Hallo, & Nguyen, 2018). Projects can be complex, multifaceted, and change over time (Boonstra & Reezigt, 2023). Complexity needs to be addressed, contained and mastered in order for projects to succeed (De Toni & Pessot, 2021).

Complex problems requires a team of subject matter experts, those affected by the problem, those that can address the problem, and those that can integrate research into practice or policy (Bammer *et al.*, 2020). Using research and project management are strategies that can be used to address complex problems (Bammer *et al.*, 2020). Research has a central role in producing knowledge and economic benefits and it has the potential to add value, innovate, and contributes to solving complex political and societal questions for industry and political decision-makers (Esko, 2020). However, most research studies are flawed (Ciliska, Thomas, & Buffett, 2008) and there have been numerous instances of data being corrupted, not reported, or not reported accurately, and this has resulted in harm (Anders, 2007; Lurie & Zieve, 2006). There are deficiencies and flaws in most published articles, and research deficiencies result in an estimated 85% of wasted biomedical research effort (Mol & Ioannidis, 2023). In 2005, a publication by Ioannidis stated that most research findings can be proven to be false (Ioannidis, 2005), and in 2011 he stated that meta-analysis often result in misleading or wrong answers (Ioannidis, 2010). Up to 40% of randomized controlled trials are left out of meta-analyses because they do not provide the necessary data and are not considered to be trustworthy (Mol & Ioannidis, 2023). There has been an increase in methodological flaws (Chen, Kang, Kuo, Glasziou, & Chen, 2021) and an increase in the number of publication retractions (Bolland, Avenell, & Grey, 2024). Recently, van Noorden published an article titled: "More than 10,000 research papers were retracted in 2023" (Van Noorden, 2023). The issues that compromise publication integrity are numerous and include analytical errors, publication bias, conflict of interest, authorship misconduct and plagiarism, falsification and fabrication (Bolland *et al.*, 2024). The trustworthiness of publications (publication integrity) is key to the knowledge that is used, and in health and public health, the trustworthiness of the knowledge that is generated, published and used can affect people's health, lives and wellbeing (Bolland *et al.*, 2024). Evidence-based decision-making is therefore compromised and not always possible, and this adds to the complexity of solving problems. Even when rigorous, high-quality studies are published, it takes on average 17 years before research evidence is integrated into practice (Morris, Wooding, & Grant, 2011). It may be helpful to get an intermediary involved to mobilize new knowledge, break down silos, facilitate integration and synergy to develop shared goals, knowledge, and language (Armstrong *et al.*, 2013; Haynes *et al.*, 2020). Creating knowledge and making sense of it as a result of dealing with complexity is a part of the life cycle of projects (De Toni & Pessot, 2021) Using research and project management for decision-making mostly involve applying known knowledge (traditional research), but the project manager can also generate new knowledge through practice-based learning to complement traditional research and move the project from the planning to execution phase (Ahern, Leavy, & Byrne, 2014). Both traditional research and practice-based experiential knowledge (real-world evidence) is necessary for the best outcome (Ahern *et al.*, 2014). If managed well, complexity can result in innovation and novel solutions, but when it is not well controlled it can result in project failure (De Toni & Pessot, 2021). According to recent statistics, 58% of organizations undervalue project management, and 50% of these organizations' projects fail (Plaky, 2023). When projects have a high degree of complexity and uncertainty, accountability, impact, learning and sustainability can be improved by connecting project management practice with theory (Ika, Munro, & Landoni, 2020). However, there is no unified theory for project management, or a convergence in research findings on what contributes to project failure or success (Daniel & Daniel, 2018). Therefore, there is a need to explore complexity and factors that contribute to it, in order to address it and improve the chances of research and project success. A study was conducted which aimed to develop a new theory to address complexity and inform knowledge creation and implementation to help project managers move a project successfully from the planning to the execution phase. The objective of this paper is to report the findings generated by a survey of researchers, project managers and decision-makers pertaining to the factors which contribute to complexity and project failure and success.

2 Methods

This research was quantitative and based on a realist ontology and a positivist epistemology (Bruce, Pope, & Stanistreet, 2018; Gauthier & Ika, 2012). The survey and interpretation of findings was informed by a critical literature review.

2.1 Critical literature review

The purpose of the critical literature review was to explore the literature and theories relevant to complexity and achieving project goals in order to inform a survey and develop a new theory. The development and discussion of the new theory is beyond the scope of this paper, but information relevant to complexity and project management is included. Data sources searched for the critical literature review included ScienceDirect, Google Scholar, PubMed, and several project management sources and journals, including SAGE Journals, PMI, PM Times, Project Management Journal, and the International Journal of Project Management. Search terms were based on theories relevant to research, evidence-based decision-making, public health, project management, and complexity. All articles that were retrieved during the literature search were screened for relevance based on the population of interest (researchers, project managers, and decision-makers); the intervention and comparators (theories of interest); and the outcomes of interest (evidence-based decision-making and project success). Exclusion criteria included articles addressing an irrelevant industry; the type of reference such as books (tertiary source), editorials, or commentaries which are considered low quality level of evidence; no full text available; and articles not in English because translation services such as Google Translate sometimes result in incorrect translation with loss of nuance. During critical reviews, the quality of articles is not assessed; rather, articles are evaluated based on their conceptual contribution (Grant & Booth, 2009). Articles that were included for data extraction were evaluated according to SPICE criteria (Cleyle & Booth, 2006) where the Setting of interest was public health; the Population of interest was researchers, decision-makers, and project managers; the Intervention of interest was simplicity or commonality theory or new ways of working; the Comparison of interest was complex adaptive systems or complexity theory; and the Evaluation of interest included factors or variables that contribute to evidence-based decision-making and project success. An updated search was conducted using Google Scholar on the 18th of March 2024 for relevant papers published in 2023 and 2024.

2.2 Cross-sectional survey

An online, web-based, internet survey was developed according to survey development guidelines and good practice rules (Aithal & Aithal, 2020; Bruce *et al.*, 2018; Creswell & Hirose, 2019; Kalkbrenner, 2021; Kelley, Clark, Brown, & Sitzia, 2003). The survey was pre-tested (n=10) and then pilot tested (n=30) and only minor changes were made after pre-testing. The final survey consisted of 60 questions that took approximately five minutes to complete. Questions relevant to the topic as well as relevant questions from validated instruments were used, including questions from the Integrated Promoting Action on Research Implementation in Health Services (i-PARIHS) (Hunter, Kim, & Kitson, 2020; Kitson *et al.*, 2008; Tucker *et al.*, 2021), the Self-Assessment TOol for Research Institutes (SATORI) (Gholami *et al.*, 2011), Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) (Green & Glasgow, 2006; Thomson & Thomas, 2012), the Complexity Assessment Tool (CAT) (Maylor, Turner, & Murray-Webster, 2013), and Organizational Resilience Potential Scale (ORPS) tool(Somers, 2009). The questions from these validated instruments that were chosen for the survey were based on themes identified during the literature review. Fifteen of the 60 questions are relevant to the objective of this paper. The survey did not include any questions of a sensitive nature, questions were neutral, and answer options were equally balanced between negative and positive answer options (i.e., yes or no; or a 5-point Likert scale with two negative, one neutral, and two positive answer options). Therefore, response bias was limited. Triangulation was used to mitigate bias and threats to validity of this research by using several data sources (literature review and the online

survey) and different participants (from several institutions and job roles) to support or disprove findings and increase the accuracy of the findings and conclusions (Latham, 2016).

Convenience sampling was used for this research because simple random sampling was not feasible due to limited time and resources. The sampling frame was social media platforms and the European Academy of Management (EURAM) website. EURAM, which has approximately 2,000 members in Europe (EURAM, 2019), posted the survey on their website for a one month period from the 18th of July to the 17th of August 2022. The survey was also posted on social media platforms (Facebook/Meta and LinkedIn) in research, project management, management, and health technology assessment (HTA) groups from the 18th of July 2022 to the 15th of August 2022, and reposted in various Facebook groups on a weekly basis during this time. One limitation of non-probability sampling methods such as convenience sampling is that it does not meet the basic assumptions of most statistical tests, and inferential test findings that use probability theory to generate p-values are meaningless (Baker *et al.*, 2013; Bruce *et al.*, 2018; Hirschauer, Grüner, Mußhoff, Becker, & Jantsch, 2020; Trafimow *et al.*, 2018; Williamson, 2003). Therefore, no statistical inference is made in this paper. Sample size calculations are also less important when convenience sampling is used. However, the sample size for this survey was calculated as the ratio of participants to variables, and 10:1 is typically used (Kalkbrenner, 2021). There were six variables in the original study, and therefore the necessary sample size required for the survey at a 10:1 ratio was 60. The variables were "research fit for purpose", research useful for decision-making, research achieving its primary goal, complexity, use of project management, and successful use of project management. However, only descriptive data relevant to complexity and project management variables will be presented in this paper.

Data from the online survey were automatically extracted into an excel sheet (not manually entered), which limited errors based on inaccurate data entry. However, coding was done manually, but all coding and results were manually double-checked to ensure accuracy. Only categorical (nominal) and ordered/ranked categorical (ordinal) data were collected in the survey. The frequencies and percentages will be summarized and reported for categorical data (including ordered/ordinal data), and frequency distribution will be displayed using bar or pie charts. Factors (categorical variables) and their frequency count will be displayed in contingency tables and the distribution modal category/category with the highest value will be stated.

2.3 Ethics

Before any participants were approached, LIGS University provided ethical clearance to conduct the study. Participants were approached via social media and a website, and because participants were from various locations around the world and at locations unknown to the researcher, it was not possible to obtain local ethics approval. Researchers, project managers, and decision-makers who were willing to participate were surveyed. No financial incentives were provided. All participants were asked to provide informed consent online before participating. Risks and benefits to participants were taken into account, and data were handled appropriately to ensure privacy and confidentiality. Data were collected anonymously via Google forms, which comply with the European Union cloud code of conduct and data protection, and GDPR. Anonymized data were stored in electronic files on a password-protected computer that only the researcher has access to. This study did not receive funding from any sponsor/source and there are no conflicts of interest to declare.

3 Results

3.1 Critical literature review

The systematic search retrieved 591 articles. After title and abstract review, 519 were excluded based on PICO criteria. After reviewing 72 full-text articles, 17 articles were excluded based on inclusion and exclusion criteria, and a further five articles were excluded during data extraction. Theories identified in the search include complexity theory, complex adaptive systems theory, systems theory, chaos theory,

knowledge translation theories, and resilience theory. Components of the various identified theories can be both useful and problematic in a public health setting. For the purpose of this paper, only a very brief summary of the various theories is provided. Complexity theory originated in economics and is a theory of adapting, developing, and evolving to survive in a changing environment (Lemke & Sabelli, 2008). According to complexity theory, complex systems and interactions can produce predictable and simple effects (Anderson, 1999; Cooke-Davies, Cicmil, Crawford, & Richardson, 2007). Complexity theory resulted in new public management, privatization, de-regulation, outsourcing of managerialism, vertical integration with stronger executive control measures and capacity, and horizontal collaboration and coordination (networks, projects, teams) (Sowels, 2021). This resulted in hybrid structures that are very complex, i.e. complex adaptive systems (Sowels, 2021). Public services became more diverse and fragmented with parts becoming mutually dependent on one another (Sowels, 2021). Complexity theory also entails cross-level research, but it creates too much ambiguity, complexity, uncertainty and unpredictability to be practical for researchers or project managers (Anderson, 1999; Cooke-Davies *et al.*, 2007; Daniel & Daniel, 2018; Mercer, 2020; Saynisch, 2010; Sialm, 2021). Complex adaptive systems theory posits that the potential of the system is more than just the sum of its parts/agents (Northam, 2014). Applying complex adaptive systems theory to project management and decision-making entails a network of teams and a similar approach to agile, but due to unpredictability and moving targets, SMART outcomes and goals are difficult to achieve (Anderson, 1999; Holland, 1992; Litaker, Tomolo, Liberatore, Stange, & Aron, 2006; Northam, 2014; Sialm, 2021). There is too much variation, even in how concepts are understood, for complex adaptive systems theory to be useful for public health systems (Jackson & Sambo, 2020). In contrast to complexity theory, chaos theory posits that simple systems and interactions can produce unpredictable and complex effects (Anderson, 1999; Cooke-Davies *et al.*, 2007). This is because system behavior is determined by the initial state or conditions, and even small changes in the initial conditions can result in large changes in system behavior (Lemke & Sabelli, 2008). There are too many variables in complex public health systems for chaos theory to be useful for either research or project management, because no hidden order is discernible and behavior cannot be modeled with so many variables (Anderson, 1999; Cooke-Davies *et al.*, 2007; Jackson, 2020; Lemke & Sabelli, 2008; Sialm, 2021). Public health systems cannot afford to apply a theory such as chaos theory where small changes or errors can result in large unpredictable effects. Systems theory was developed by Von Bertalanffy and resulted in a systems approach where complex systems can be reduced to its components and the relationships between components (Lemke & Sabelli, 2008). Systems theory uses methods such as evidence-based management and quality improvement which are both very relevant to research and project management, and it embraces numerous methods and theories to understand complex systems and slack resources to reduce interdependency (Daniel & Daniel, 2018; Esko, 2020; Jackson & Sambo, 2020; Jerejian, 2020; Lemke & Sabelli, 2008; Midgley & Lindhult, 2021; Oakden, 2019; Saurin, 2021). However, systems theory has problems with generating generalizable research, there is no consensus about system thinking methods and concepts, methods lack rigor, and systems theory is still in the theory stage and more conceptual rather than applied practically (Jackson & Sambo, 2020; Rusoja *et al.*, 2018). Knowledge translation generally involves the knowledge synthesis, dissemination, exchange, and application to "improve outcomes within a complex system of interactions between knowledge producers and knowledge users" (p. 2) (Mallidou, Atherton, Chan, & *et al.*, 2018). There are numerous knowledge translation theories, models and frameworks, but the vast majority are rarely used, and therefore, have questionable practical usefulness (Strifler *et al.*, 2018). Resilience means having the capacity to bounce back (Pessina, 2021). It can be seen as an outcome, process, system trait, or strategy to deal with uncertainty (Moser, Meerow, Arnott, & Jack-Scott, 2019). Characteristics of resilience as an outcome include having a decreased vulnerability and risk to assets, people, and structures, improved psychological outcomes such as motivation and self-efficacy, and increased equity and independence (Moser *et al.*, 2019). The literature review identified a gap in the literature applying commonality and simplicity theories to public health. Issues identified in the critical literature

review and during assessments of the various theories which relate to complexity, research, project management, and decision-making informed the survey questions.

3.2 Cross-sectional survey

A total of 114 participants responded to the survey. The survey was posted online in relevant researcher, project manager, and decision-maker groups with a total of 167,864 members across all groups. Therefore, the response rate (114/167,864 x 100) was 0.07%, indicating response bias. Sampling error could not be calculated because it was a non-probability sample. Among the 114 participants, there were 55 researchers (48.2%), 36 project managers (31.6%), and 23 decision-makers (20.2%). Unfortunately, it is impossible to know how responders differ from non-responders because the demographics of the various online groups where the survey was posted are not publicly available. Table 1 provides an overview of the demographic characteristics of the survey participants.

Table 1: *Demographic characteristics of survey participants: Frequency distribution by role and industry*

		Decision-Maker		Project Manager		Researcher		Total	
		N	%	N	%	N	%	N	%
Industry	Communication	1	4.3%	9	25.0%	3	5.5%	13	11.4%
	Education	3	13.0%	4	11.1%	16	29.1%	23	20.2%
	Health	4	17.4%	3	8.3%	8	14.5%	15	13.2%
	Infrastructure	1	4.3%	2	5.6%	2	3.6%	5	4.4%
	Other	11	47.8%	11	30.6%	22	40.0%	44	38.6%
	Technology	3	13.0%	7	19.4%	4	7.3%	14	12.3%
Total		23	100.0%	36	100.0%	55	100.0%	114	100.0%

Less than half of participants (42.1%) indicated that decisions are mostly based on evidence, followed by company policies or guidelines (19.3%), expert opinion (14.9%), consensus (10.5%), gut-feel (7%) or politics/ideology (6.1%). Interestingly, the majority of participants who indicated that decisions are based on gut-feel are decision-makers (21.7%); whereas the majority who indicated decisions are based on evidence are researchers (47.3%). Approximately 46% of participants thought current research methods and practices are appropriate to solve societal problems (>3 on a 5-point Likert scale where 1 = "not at all" and 5 = "to a large extent"). The modal category was 4 for the overall sample. Most participants (56.1%) thought that poor quality data/research/evidence were the biggest barrier to using research in practice.

Two-thirds of all participants reported that complexity was a problem in their line of work - 69.6% of decision-makers, 55.6% of project managers, and 72.7% of researchers. Approximately half (50.9%) of all participants rated their work as >3 on a 5-point Likert scale, where 5 means it is extremely complex. The modal categories are presented in Figure 1.

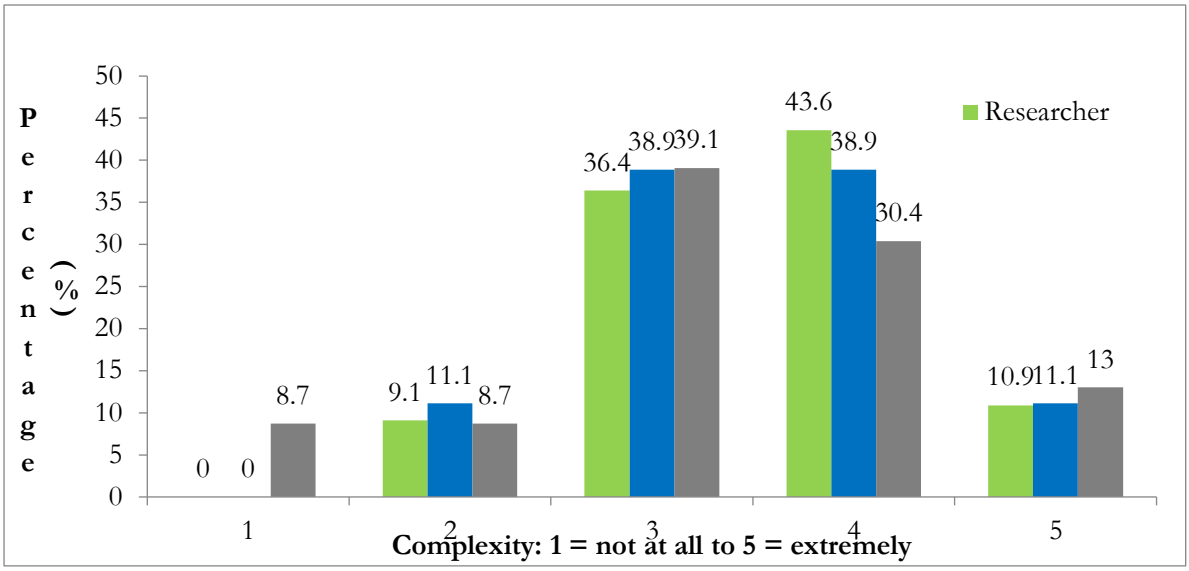

Figure 1: *Level of perceived work complexity by role*

Paradoxically, when complexity of participant's work was assessed using questions from the CAT questionnaire, total complexity scores tended to be low. The modal category was 2 out of a maximum of 15 (Figure 2).

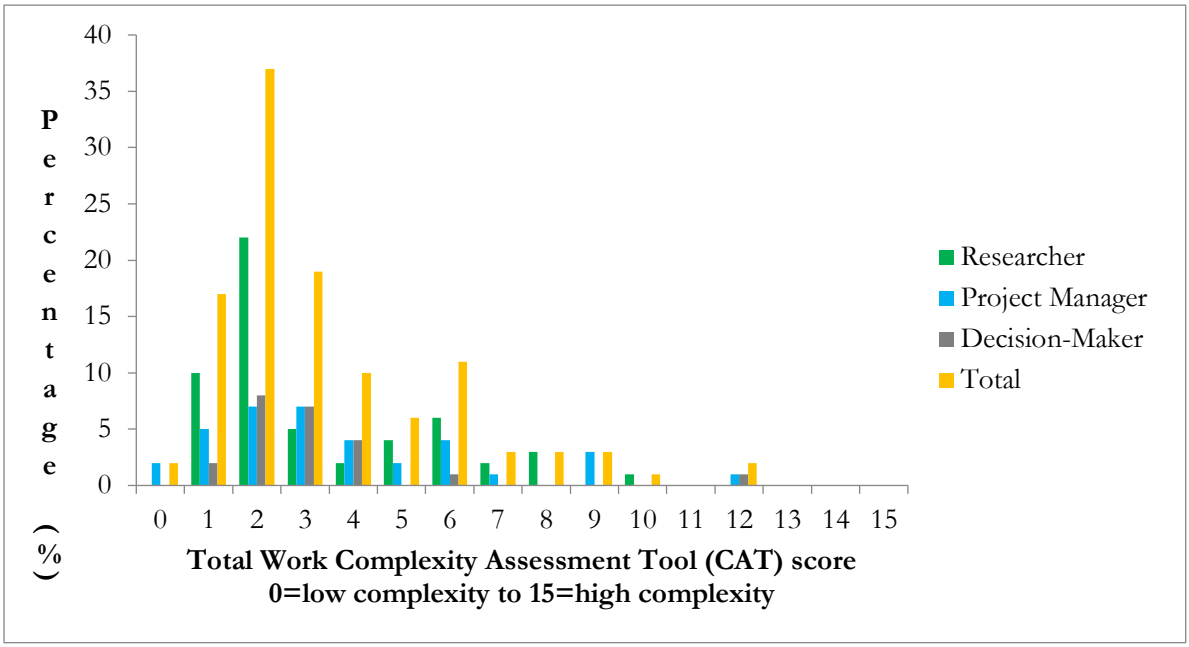

Figure 2: *Total work complexity score by role*

Of the options provided, most participants chose people and interactions between people as the factor that contributes most to complexity in the workplace (36%), followed by processes and policies, tools and technologies, and the number of factors to consider as part of participants' work (Figure 3).

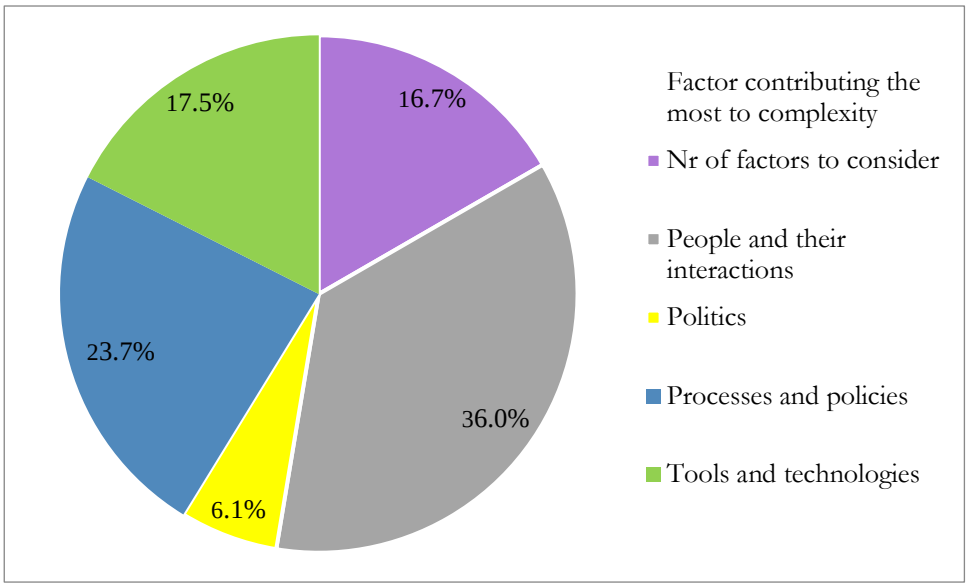

Figure 3: *Factors that contribute to complexity by percentage*

Approximately half of all participants (50.9%) thought that simplifying their work would increase productivity and outcomes, while 18.4% did not think so, and 30.7% were unsure. However, only 38.6% of participants prefer simplicity to achieve goals if it means that accuracy is lost. The majority (61.4%) prefer complexity if accuracy is increased, even if it means moving goals that take longer to achieve. However, most participants (65.8%) indicated that complexity, rather than oversimplification contributes to project failure. Additionally, most participants (74.6%) are only able to consider 3-5 factors when making decisions before feeling overwhelmed, 13.2% are able to consider ≥6 factors, and 12.3% are able to consider only 1-2 factors before feeling overwhelmed.

Approximately two-thirds of participants (67.5%) indicated that large organizations are not more efficient and productive than small organizations. The factor that prevented most participants from achieving their goals was poor communication and collaboration, followed by too little time and resources (Table 2). The lowest percentage of participants (2.6%) chose tools and technologies as a factor that prevented them from achieving their goals.

Table 2: *Factors preventing goal achievement by role*

		Decision-Maker		Project Manager		Researcher		Total	
		N	%	N	%	N	%	N	%
Which of the following is the biggest factor that prevents you or your team from achieving your goals?	Lack of knowledgeable and skilled people	4	17.4%	5	13.9%	6	10.9%	15	13.2%
	Managers/leadership	3	13.0%	6	16.7%	7	12.7%	16	14.0%
	Politics	0	0.0%	2	5.6%	2	3.6%	4	3.5%
	Poor communication and collaboration	8	34.8%	12	33.3%	19	34.5%	39	34.2%
	Too little time and resources	7	30.4%	11	30.6%	19	34.5%	37	32.5%
	Tools or technologies	1	4.3%	0	0.0%	2	3.6%	3	2.6%
Total		23	100.0%	36	100.0%	55	100.0%	114	100.0%

Most participants (59.6%) indicated that 4 to 5 people are the ideal team size for optimal performance or project success (Figure 4).

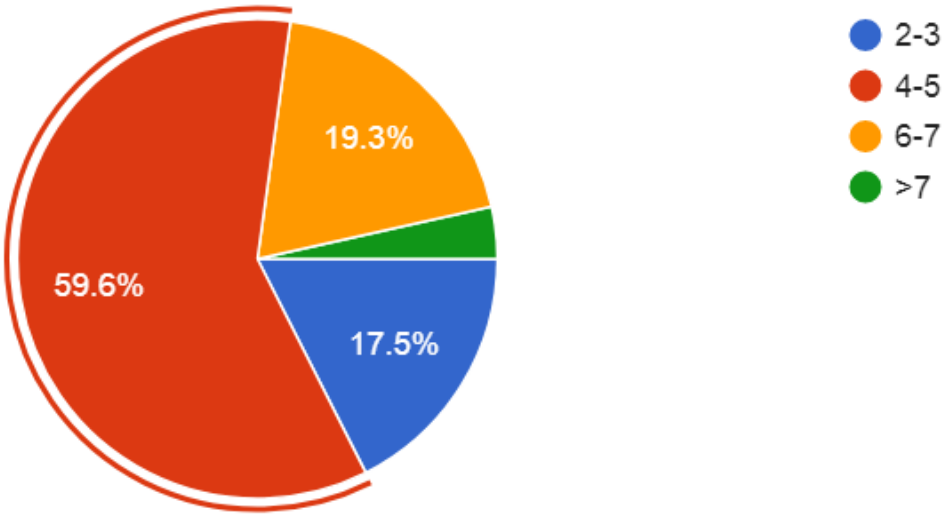

Figure 4: *Frequency distribution of ideal team size for optimal performance*

Participants mostly prefer to work with people they have a lot in common with, followed by working alone, while working with a diverse group of people was chosen by the fewest participants (Figure 5). Participants could choose more than one option and therefore the sum of percentages is more than 100%.

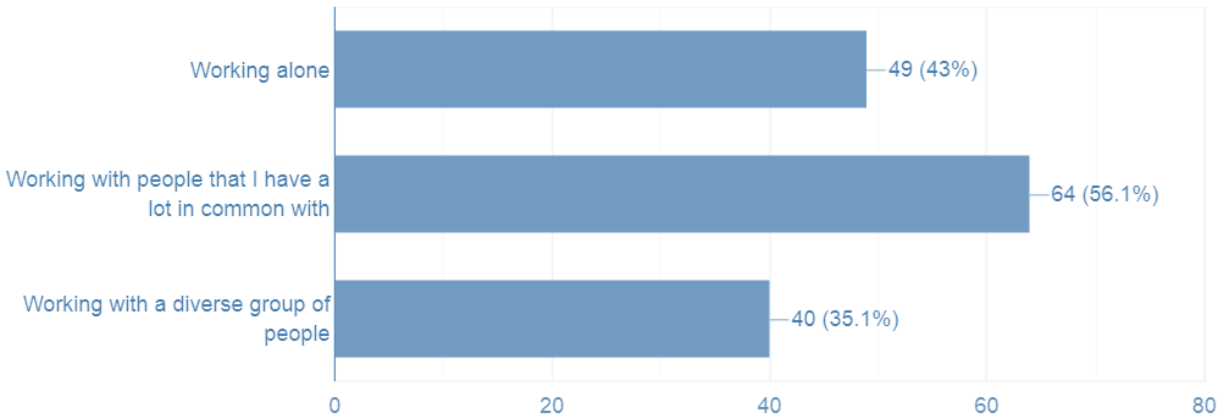

Figure 5: *Preference for whom to work with*

Seventy-two participants responded to an open question about factors that contribute most to their project success. The main themes that emerged included personal characteristics such as ambition, attitude, confidence, commitment, dedication, diligence, emotional intelligence, motivation, morale, values, well-being, and work ethic (n = 18), good, efficient communication, and collaboration (n = 17), skilled and knowledgeable people (n = 8), and good teamwork and trust (n = 8). Most participants (57.9%) indicated that feeling valued, respected, and having pride and finding satisfaction in their work is what motivates them most to perform well (Figure 6). This was followed by being rewarded (18.4%) and getting clear direction and instructions (9.6%), fear of punishment or failure (7.9%), and lastly, having autonomy and control (6.1%).

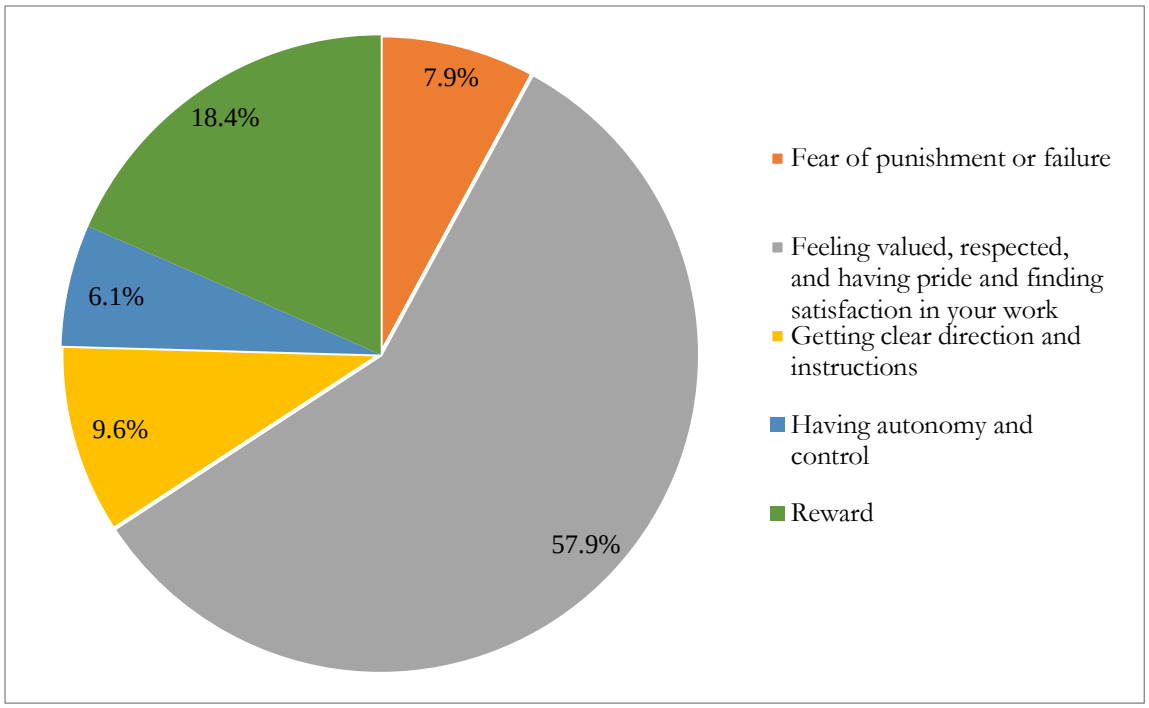

Figure 6: *Factors that motivate participants most to perform well at work*

Interestingly, more decision-makers (26.1%) were mostly motivated by fear of punishment or failure compared with project managers (2.8%) and researchers (3.6%), whereas more researchers were motivated by reward (23.6%) compared with decision-makers (13.0%) and project managers (13.9%). Seventy-seven participants responded to an open question about what would make people prioritize team or organizational goals and interests over their own interests. Main themes that emerged included being rewarded (n = 27), having good relationships with colleagues, good teamwork and collaboration, and a sense of belonging (n = 16), and having their own values or goals align with organizational/team values or goals (n = 14).

Most participants (74.6%) use project management for their projects (Table 3), and all of these participants indicated that project management contributed to the success of their projects. Interestingly, 11% of project managers indicated that they do not use project management. More participants who do not use project management compared with those who do (20.7% vs. 1.2%, respectively), rated research as less useful for decision-making than not (<3 on a 5-point Likert scale). The opposite was also true where more participants who use project management compared with those who do not (82.3% vs. 72.4%, respectively) rated research as more useful for decision-making than not (>3 on a 5-point Likert scale).

Table 3: *Frequency distribution of participants using project management by role*

		Decision-Maker		Project Manager		Researcher		Total	
		N	%	N	%	N	%	N	%
Do you use project management in your research/projects?	No	7	30.4%	4	11.1%	18	32.7%	29	25.4%
	Yes	16	69.6%	32	88.9%	37	67.3%	85	74.6%
Total		23	100.0%	36	100.0%	55	100.0%	114	100.0%

4 Discussion

Less than half of participants perceive current research methods and practices as appropriate to solve societal problems, and less than half of participants indicated that decisions are mostly based on evidence. Interestingly, the majority of participants who indicated that decisions are based on gut-feel were decision-makers, whereas the majority who indicated that decisions are based on evidence were researchers. The finding that decision-makers were more likely than other roles to base decisions on gut-feel may be because decision-makers eliminates information by aspects and throw away information if it is too much to make it manageable (Van Arsdale, 2021). Failures in information flow include having too much information to process; too little information to be useful; or a delay in information, i.e. not timely enough to be useful (Van Arsdale, 2021). There appears to be a gap in perspectives between researchers and decision-makers about the usefulness of research for decision-making, and a need for an intermediary between researchers and decision-makers to reduce complexity and ensure that the knowledge that is created is useful to decision-makers. Most participants thought that poor quality data/research/evidence was the biggest barrier to using research in practice. If data is of poor quality or unreliable, the output would be useless or harmful (Larson, 2020). Therefore, it is important to ensure that high quality data is collected, reported and analyzed, and that assumptions are checked and corrected as new data and information becomes available (Larson, 2020). Generating relevant, accurate and timely knowledge that is useful to decision-makers is a complex process in desperate need of streamlining.

With regards to complexity, there was a discrepancy in the extent of perceived complexity based on how complexity was assessed (yes/no answers, 5-point Likert Scale, or CAT questions). Briefly, two-thirds of participants said complexity was a problem at work at the yes/no question, compared with 50.9% who rated their work as more complex than not (>3 on the 5-point Likert scale). Additionally, when complexity of participants' work was assessed using questions from the CAT questionnaire, total complexity scores tended to be low (modal category of 2 out of 15). This paradox could point to poor internal consistency of the survey, or problems with the CAT questionnaire, or it could be that questions from the CAT that were included in the current survey, were not questions that addressed specific complexity issues experienced by participants. If the latter is the case, then there is a discrepancy between factors identified from the literature (since the questions were mostly chosen based on the literature review) and what participants in this study sample experience in real life. The inconsistency could also point to participants' flawed perceptions.

The majority of participants think that simplifying their work would increase productivity and improve outcomes. Two-thirds of participants indicate that complexity, rather than oversimplification contributes to project failure. With complexity comes retrospective understanding of cause and effect; if cause and effect is unclear, it becomes too confusing to base decisions on research/knowledge, and outcomes become unpredictable and erratic (Mercer, 2020). In contrast, simplicity is faster and more productive (e Cunha & Rego, 2010). With simplicity there are rules, a stable situation, cause and effect relationships, best practice, few components, near-linear behavior, and it is easier to describe, predict, and manage outcomes (Mercer, 2020). However, Bicket warns that oversimplification can lead to misleading conclusions (Bicket *et al.*, 2021). This was also a concern for survey participants, because the majority prefers complexity if it means accuracy is increased, over simplicity if accuracy is lost. However, three-quarters of participants are only able to consider 3-5 factors when making decisions before feeling overwhelmed, and some are only able to consider 1 or 2 factors before feeling overwhelmed. Therefore, cognitive ability may limit the level of complexity that can feasibly be handled regardless of preference. According to simplicity theory, complexity easily overwhelms most people, and people make more mistakes as complexity, the number of outcomes, and uncertainty increases (Puri, 2018). People prefer simple binary options, i.e. yes/no, it happens/it doesn't happen, etc. (Puri, 2018). Therefore, plausibility may be a more feasible goal than accuracy in highly complex settings. Lunkka *et al.* suggests that plausibility is more important than

accuracy (Lunkka, Pietilainen, & Suhonen, 2019). To improve outcomes, it may be important to set realistic goals and simplify work in congruence with employees' cognitive abilities.

In the survey, people and their interactions was chosen by most participants as the factor that contributes the most to complexity, and the biggest factor that prevented participants from achieving their goals was poor communication and collaboration, followed by having too little time and resources. Seventy percent of complexity is due to human nature according to some estimates (Jackson, 2020). An interesting finding of the survey was that participants prefer to work with people they have a lot in common with or alone over working with a diverse group of people. This is similar to another study which found that diversity is important for the minority, whereas most prefer to work with "like-minded" (p. 9) people (Ford *et al.*, 2021). One reason for this may be that as diversity increase, perceived threat can increase which reduce trust and cohesion (Laurence, Schmid, & Hewstone, 2019). Herring summarized some of the benefits and problems of diversity, with benefits including increased human resources to solve problems, gaining a wider perspective, creativity, better solutions, and strengthening teams, while problems include "significant potential costs" (p. 208) due to increased conflict, reduced communication and cohesiveness which increase turnover and absenteeism, and lower work quality and performance (Herring, 2009). A recent systematic literature review state that further research is required to explore the role diversity plays in team dynamics (Jallow, Rovelo, Gharaee, Dutta, & Askari, 2023).

The study mentioned previously also found that most people prefer to collaborate with people they know (Ford *et al.*, 2021). This is in line with another study which reported that people find multidisciplinary and intra-organizational collaboration challenging and a negative experience, and it might be because people have to work with others they don't know (Lunkka *et al.*, 2019). These studies were relatively small qualitative studies, and the current, larger quantitative survey appears to support these findings. This is an important issue, because it is thought that social issues contribute to the majority of project costs because of the complexity created by putting people with different backgrounds together in project teams (Cooke-Davies *et al.*, 2007). Teams with stable membership have been found to perform better than those with constantly rotating members (Mauboussin & Majd, 2017). When teams and team members are familiar with each other, they exhibit more positive behaviors and improved performance because they communicate (and share and pool information) more than when teams are unfamiliar with each other (Brown, 2020). Team performance depends on team composition and configuration, as well as on the attributes of team members (ability, adaptableness, agreeableness, and flexibility) (Bell, Brown, & Weiss, 2018). Therefore, team performance may be improved by reducing complexity created by human nature and social issues by focusing on commonalties and stability within the teams rather than on diversity. However, due to globalization, diversity within countries and organizations is increasing, but the negative effects of diversity may be managed by grouping people with a lot in common into a team and having a diverse group of teams each fulfilling their own function (i.e. diversity between teams rather than inside of teams), but all ultimately working towards the same goal.

Approximately two-thirds of participants indicated that large organizations are not more efficient and productive than small organizations. According to the literature, an increase in organizational size has been found to increase complexity and requires more coordination (e Cunha & Rego, 2010). Larger organizations and larger team sizes are likely to require more interactions and increase complexity. A metric of complexity is the number of interactions in the system, i.e. an increased number of interactions result in an increase in degrees of freedom for the system, and increase risk of disequilibrium (Van Arsdale, 2021). Increased interactions increase information loss; therefore, to reduce complexity and improve outcomes, it is important to manage interactions (Van Arsdale, 2021). The complexity threshold of maximum interactions humans can manage is 5-7 before humans start chunking information into larger pieces with less detail (Van Arsdale, 2021; West *et al.*). In the current survey, most participants indicated that 4-5 people are the ideal team size for optimal performance or project success. With larger teams there is an increase in information and skills that can contribute to the project, but effective coordination and communication becomes more difficult (Mauboussin & Majd, 2017). A formula to calculate the lines of communicaiton

required based on team size is: N(N-1)/2 (Van Der Schouw, 2015). If team size increase from 5 to 7, the lines of communication doubles, and this can quickly become unmanageble in large teams (Van Der Schouw, 2015). This is an important consideration, because it has been estimated that "90% of project management is communication" (p. 19) (Van Der Schouw, 2015). Communication plans can help to ensure that everybody is clear about who should be notified about what, how often and in which way (Biafore, 2019; Project Management Institute, 2017). As team-size increase, collaboration and cohesion (along with problem-solving) decreases (González-Piñero, Páez-Avilés, Juanola-Feliu, & Samitier, 2021). Smaller teams of 6 or less are generally more cohesive, flexible, and easy to manage (Alexander, De Smet, Kleinman, & *et al.*, 2020; Garner & bookboon.com, 2012). Therefore, one way to reduce complexity and improve communication and performance may be to keep teams small. In larger organizations, or projects involving many people, a useful component that organizations can apply from complex adaptive systems theory, is a network of teams. A network of teams can reduce complexity and improve performance by reducing hierarchy and increasing the sense of working towards a shared goal. Organizations with a highly hierarchical structure can have a lot of bureaucracy which results in teams working in silos and decreasing performance due to a reduced ability to make decisions and act autonomously (Kristensen & Shafiee, 2019). According to some, a team-based organization is the way forward and is most effective in responding to uncertainties and complex demands (Nyyssola, 2020). However, less hierarchy can result in confrontational culture, dysfunction and complicates decision-making (Gorod *et al.*, 2018). Therefore, the right balance must be achieved when it comes to hierarchy vs. autonomy, and centralization vs. decentralization.

It is also important to determine what motivates people to perform well at work. Low-ranking employees often determine the fate of big companies, and companies must know how to motivate and stimulate employees to make them willing to contribute and collaborate (e Cunha & Rego, 2010). Participants indicated that feeling valued, respected, and having pride and finding satisfaction in their work is what motivates them most to perform well, followed by being rewarded. This is in line with the literature where trust, respect, and feeling valued were found to be important to build a "coalition of the willing" (p. 92) (Campbell, 2021). Similarly, according to resilience theory, resilient organizations are characterized by improving psychological outcomes of employees such as motivation and self-efficacy (Moser *et al.*, 2019). Participants responded to an open question about what would make people prioritize team or organizational goals and interests over their own interests. Themes that emerged included being rewarded, good relationships with colleagues, good teamwork and collaboration, and a sense of belonging. Teams must consist of the right people with the right generalist/multidisciplinary skill-sets that work together to get things done (De Smet, Lurie, & St George, 2018). A high-performing innovative team has the ability to share and integrate knowledge and being motivated to learn (Super, 2020). As mentioned before, team performance can be affected by changing members and team composition (Bell *et al.*, 2018). Team members must develop trust quickly, collaborate and communicate very well to perform well (Bell *et al.*, 2018). This can be achieved by having clearly defined roles, or recruiting people who know each other either by having worked together previously and trusting each other's competence, or knowing someone by reputation and expertise (Bell *et al.*, 2018). Collaborative relationships can infuse dynamism and energy during crisis response, but diversity, multiplicity, competing for scarce resources, political decision-making, and lack of standardization adds to complexity and creates management challenges (Durugbo, Almahamid, Budalamah, Al-Jayyousi, & BendiMerad, 2021).

Seventy-two participants responded to an open question about factors that contribute most to their project success. Themes that emerged included personal characteristics, good, efficient communication, and collaboration, skilled and knowledgeable people, good teamwork and trust, clear goals, guidance and clear roles, and good planning, organization, and coordination amongst others. According to the literature, factors that contribute to a project's success, include support from top management, a clear mission and procedures, effective communication, and a cohesive collaborative team (Anantatmula, 2015). Leaders must ensure that they pick competent members for teams who can execute their roles and responsibilities, and provide training and development where needed (Forsyth & bookboon.com, 2019). Failure can be mitigated

by hiring people with the right knowledge and skills, valuing those knowledge and skills, and building a work environment where people can collaborate and thrive (Razak, 2020). People and culture is one of the key factors that play a role in organizations and their performance (Kristensen & Shafiee, 2019). There are seven elements to building a high-performance team: 1) setting direction with a clear vision, mission, purpose, and strategy; 2) gathering and deploying resources where needed; 3) assembling a team with the right people, right skills and chemistry; 4) allocating work and priorities, and matching priorities to resources and goals; 5) executing the plan by making decisions, handling any politics or agendas, measuring outcomes and adjusting as needed; 6) motivating by giving authority, assigning responsibility, resolving conflict, providing feedback, celebrating success, and accepting failure; and 7) develop team and individual capabilities, succession plans, and exporting talent (Figliuolo, 2018). Effective communication, good project management, and brokers or intermediaries are reported as key for collaboration (Ford *et al.*, 2021). The current research suggests that project managers may be able to act as intermediaries or brokers.

Use of project management was assessed in the survey to determine whether participants thought that project management contributes to the success of their projects. Three-quarters of participants use project management, and all of these participants indicated that project management contributed to the success of their research or projects. Participants who use project management also rated research as more useful for decision-making. Therefore, project management may be able to improve the usefulness of research for decision-making. Unfortunately, it was not possible to assess these findings objectively by directly linking project management use to research and project outcomes. The fact that the survey is based on subjective assessments rather than objective measurements is a limitation of this research. However, the results are supported by various publications. According to the literature, complexity is at the root of failure and reduces sense-making (e Cunha & Rego, 2010). Project management is one way in which organizations can try to reduce complexity and bureaucracy and streamline processes to be more efficient and decisive, foster collaboration, improve innovation and entrepreneurship, and add value (Lunkka *et al.*, 2019). Complexity can vary between project content, internal context (for example stakeholder relations), and external environment (for example becoming too reliant on one vendor) (Boonstra & Reezigt, 2023). There are components of systems theory that can be applied to reduce complexity related to project content, internal context, and the external environment, for example evidence-based management, quality improvement, and slack resources to reduce interdependency (Daniel & Daniel, 2018; Esko, 2020; Jackson & Sambo, 2020; Jerejian, 2020; Lemke & Sabelli, 2008; Midgley & Lindhult, 2021; Oakden, 2019; Saurin, 2021). Similarly, there are components from resilience that could be beneficial, including situational awareness, having enough resources available, and innovations and tools to adapt to the changing situation (Pessina, 2021). Project managers can employ crisis and risk management in resilient systems and ensure there are slack resources, a mix of skills among employees for surge capacity, collective action and collaboration, standard operating procedures and checklists, and effective monitoring and evaluation (Moser *et al.*, 2019; Pessina, 2021; Somers, 2009).

Various strategies may be needed for effective project management, but combining strategies can increase uncertainty (Boonstra & Reezigt, 2023). A large survey found that top-performing organizations mostly use predictive (traditional/waterfall) project management approaches (44%), followed by agile approaches (30%) (Plaky, 2023). Reasons for project failure include inconsistent approaches, poor management, poor training, and lack of planning, skills, and resources (Plaky, 2023). Problematic conditions for project managers in public organizations include weak governance frameworks with a lack of clear roles, responsibilities and accountabilities, and a complex stakeholder landscape with "multiple stakeholders with diverse interests" which creates "challenges in governance…coordination, communication, and decision-making" (p. 8) and exacerbates difficulties in project delivery (Rowe, Whitty, & van der Hoorn, 2024). Organizational and work breakdown structures (WBS) and "RACI (responsible, accountable, consult, and inform) charts" (p. 261) may help to clarify roles and responsibilities for project deliverables (Project Management Institute, 2017).

According to the literature, rapid decision-making appears to be a key factor in project success. When leaders make decision in less than an hour, 58% of projects succeeded vs. an 18% success rate when leaders took five hours or longer to make decisions (Plaky, 2023). Political aspects have a strong influence on implementation and the efficiency and speed of decision-making (Mitterer, 2018). Rational decision-making is limited by limited time, complexity of the problem, and cognitive limitations (Coccia, 2020). Rational decision-making considers probabilities and choose the option with the highest expected value (Coccia, 2020). A clear centralized strategy and governance structures with clear roles and responsibilities are needed (Mitterer, 2018). Steps of critical decisions include reductionism, rational structures, tree diagrams, and a systematic process (Coccia, 2020). In other words, complexity needs to be reduced and researchers and project managers can play an important role. Resilient organizations focus on innovations to have support tools available for decision-makers for smart adaptation during times of uncertainty and unpredictability (Pessina, 2021). In resilient systems there is a coproduction of knowledge, anticipatory techniques are deployed, and open, accurate, transparent, real-time data is shared in the public domain (Moser *et al.*, 2019; Pessina, 2021; Somers, 2009). Researchers and policy makers can also provide benchmarks for resilience by using data that is publicly available (Tiernan *et al.*, 2019). The implication of resilience theory for researchers is that they can learn from the past, learn from what has worked, as well as generate and apply new knowledge (adsorptive capacity) (Pessina, 2021). Decision-makers in resilient systems are proactive, give strong direction, and take advantage of opportunities to increase flexibility and readiness for change (Moser *et al.*, 2019; Pessina, 2021; Somers, 2009). Decision-makers are responsible for doing the right thing, setting the direction, providing motivation, and resources, address concerns, and build resilience (Leduc, 2018). Decision-makers, with the help of project managers can conduct a risk/benefit assessment from a societal perspective. The ultimate test of a decision is to ask whether the decision will be in the best interest of the project, organization, and for achieving the goal (Figliuolo, 2018). If the answer is no, stop immediately and reassess; if the answer is yes, then proceed (Figliuolo, 2018). One tool for decision-making is the Health Evidence Network Synthesis Report and it includes steps for improving research and policy development, including conducting a situational analysis, having a strategy to evaluate the impact of research on policy and practice, and collaboration between stakeholders (Chhetri & Zacarias, 2021). The most reliable evidence should be used to base policies on to ensure value is added, and researchers and policymakers should interact on a regular basis to ensure policies are based on the most effective and reliable evidence. Project managers can act as intermediaries between researchers and decision-makers and numerous project management strategies (as discussed above) can be applied to reduce complexity, streamline processes, and ensure adequate communication and coordination to ensure project success.

5 Conclusion

Complexity is a problem for researchers, project managers, and decision-makers, and wicked problems are difficult to manage and solve. Decision-makers need rapidly produced, relevant, accurate research and knowledge to base their decisions on. In the current study, less than half of participants indicated that decisions are mostly based on evidence, and most participants thought that poor quality data/research/evidence was the biggest barrier to using research in practice. Complexity at work was identified as a problem for participants, but project management contributed to project success for all participants who use project management. The main factor chosen by most survey participants that plays a role in complexity and project success, is people and their interactions. Keeping organizations and team size small could improve efficiency and performance. Ensuring that the right people are chosen, with a focus on cohesion and skills, is important for good teamwork and achieving organizational goals. If possible, let people work with others they have a lot in common with or with people they know and trust. If this is not possible, focus on commonalities (goals) rather than individuality, and motivate people to work towards a common goal by valuing them and rewarding them adequately. Project managers and project management strategies may be able to play a valuable role in reducing complexity and improving the chances

of project success. This paper provided project management strategies and discussed useful components of various theories that could help researchers, project managers, and decision-makers work better together towards achieving project success.

6 Declarations

6.1 Study limitations

The survey is based on subjective perspectives of participants rather than objective measurements of outcomes. Another limitation of this study is the non-random sample.

6.2 Acknowledgements

Many thanks to the participants who responded to the survey.

6.3 Data availability

Anonymized data from the survey is available upon request.

6.4 Informed Consent

Participants provided informed consent online before participating in the survey

6.5 Competing Interests

There is no conflict of interest to declare.

6.6 Publisher's Note

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