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Pets and Planet: Systems Thinking Perspectives on Ownership, Care and Abandonment Under Climate Uncertainties

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Abstract

The pet care sector is a highly complex socio-ecological system that sits at the intersection of environment and animal welfare. Humanization has transformed the human-pet relationship beyond companionship into one that is subjected to a higher standard of care, blurring the lines between animal welfare and commodification. As new markets increasingly promote consumption by appealing to pet owners to 'do what's best' through purchasing behaviors, climate shocks may threaten resource availability, making sustaining similar levels of care a future challenge to pet owners. This study aims to develop a systemic understanding of the pet care system in Malaysia, a middle-income country with a growing pet population and diverse cross-sector collaboration. Systems thinking provides an effective approach to studying these complexities and interactions in a structured and collaborative manner. This study presents the first application of the Participatory Systems Mapping ('PSM') methodology to develop iterative causal loop diagrams (CLDs) across three dimensions: pet ownership, care quality and pet abandonment. Insights reveal that while many factors influence consumer behavior, unsustainable care practices expose pet owners to systemic vulnerability which reinforce poor animal welfare outcomes. The CLDs inform the development of a framework for sustainable pet care, including proposed interventions related to consumer education and awareness from a sustainability lens.

Keywords: Companion animal welfare, pet abandonment, sustainable consumption, systems thinking, causal loop diagram

Introduction

Increasing urban isolation and a strong desire for more-than-human connection has led to higher accounts of pet ownership across the world. This evolution in the human-pet relationship from function to companionship promotes a breadth of new research on companion animal welfare. Humanization is identified as a driving factor for increased appetite for pets, a common phenomenon influencing the treatment of companion animals as family members, especially akin to children (Genç & İnce, 2025; Atherton & Moore, 2016). While pet humanization could yield positive animal welfare outcomes by playing a mediating effect on the human-pet bond, including one's willingness to adopt (Butterfield et al., 2012) and decisions not to abandon (Lu et al., 2026), negative outcomes have also been noted, such as the unethical breeding of pets (Laura et al. 2023) and infantilization for the sake of human pleasure (Atherton & Moore, 2016). In extreme cases, pets are granted pure economic value, serving as extensions of human expression and identity akin to fashion accessories, rather than emotional companions (Genç & İnce, 2025). These findings reveal that blurry lines are forming between humanization and commodification, with new care standards replacing the ruler for quality in societies with more humanized pet relationships. As pets become an integral part of human life, their care becomes more strongly influenced by consumerist tendencies (Genç & İnce, 2025).

While consumption is not inherently harmful, there are real negative implications to mixing consumption and care when it comes to pets. In particular, *what happens when pet owners can no longer afford similar levels of care?* Studies on pet abandonment explored reasons why pet owners give up their animal companions. Owner factors, such as moving or unrealistic



commitments, are mostly cited after aggressive animal behaviors (Lambert et al., 2019; Coe et al., 2014). Macroeconomic factors could also impact abandonment decisions; for example, animal shelter workers cited economic downturn and drop in household income as underlying causes for abandonment in the United Kingdom (Leifer, 2026). Given this perspective, climate change presents itself as an imminent risk to macroeconomic stability with strong ties to consumption, encouraging new research exploring the impact of climate change on pet care, and vice versa.

The human-pet relationship is therefore a complex system that touches ownership, care quality, and abandonment. In Malaysia, 51% of households are reported to own pets (Standard Insights, 2023), yet unmanaged stray animal populations are becoming of increasing concern within public opinion, in light of animal abuse cases (Munir et al., 2023; Bahaudin, 2026). At the same time, legislation enforced through the Animal Welfare Act 2015 and considerations of budget allocation for stray animal management (The Star, 2026) suggests that the country may be receptive towards animal welfare as a policy priority. Malaysia presents a unique case study to explore these relationships, filling a clear research gap in animal welfare studies, majority of which are Western-centric (Coe et al., 2014). Taken together, this study aims to explore the following questions:

- RQ1: What factors drive consumer decisions on pet ownership, care and abandonment?
- RQ2: How do climate shocks impact the sustainability of care systems?

To answer this question, we position this study as the first attempt to understand the dynamics of the pet care system using a systems thinking methodology. Participatory Systems Mapping (PSM), which draws on systems thinking, is recognized as one of the effective approaches to gather insights from key influential stakeholders in a collaborative manner (Miller et al., 2025). The rest of this study is organized as follows. First, we present the methodology used with stakeholders in developing the causal loop diagrams (CLDs). Second, we present the CLDs and synthesize the causal relationships towards understanding the drivers of pet care and its welfare implications. Third, we conceptualize these findings in a framework to inform future interventions on advocacy and policy.

Methods

Participatory systems mapping

Systems thinking provides a structured approach to studying complex systems, thus facilitating a comprehensive understanding of its elements and dynamics (Bertscher et al., 2024). The pet care system in Malaysia cuts across diverse sectors with varying constraints and objectives: industry players, non-profit organizations, veterinary practices and consumers. To apply this in practice, we adopt Participatory Systems Mapping (PSM) to gather diverse stakeholders in co-creating a true representation of system dynamics (Barbrook-Johnson & Penn, 2021). A physical workshop with identified stakeholders was conducted to inform the development of CLDs for this study. The workshop was designed as a half-day program, and stakeholders



were identified based on their involvement and perceived influence on their respective communities, and propensity to engage in sustainability discourse. A total of 20 stakeholders were invited to participate, of whom 3 did not respond, 5 had declined due to scheduling conflicts and 12 had accepted and attended the workshop. Informed consent was obtained from all subjects involved in the study. By design, a maximum of twelve participants were recommended (ibid). Participants were divided into three groups, each comprising one representative from every sector, so as to ensure balanced input and reduce biases during the exercise.

Instead of validating a preliminary conceptual map (Bertscher et al., 2024), participants built a systems map from a blank canvas, following a guided approach as outlined in Kumar et al. (2026). Pre-readings on the impact of climate change on companion animals and the methodology were sent to participants prior to the workshop with stated research objectives and workshop outcomes.

Mindful of time limitations during the workshop, we adapted a simplified six-step PSM methodology (see Kumar et al., 2026). In Step 1, problem scoping and participant selection is as described in the previous paragraphs. In Step 2, three focal themes were identified. In addition to being measurable and capable of increasing or decreasing (ibid), the selection of focal themes were assessed based on their relevance to the problem scope: (1) they are representative of the entire pet care lifecycle from start to end (2) they can translate to clear desirable or harmful outcomes.

The pet care lifecycle starts from *ownership* or the acquisition of a companion animal through different pathways, either through the adoption of a stray, feral animal or abandoned, but domesticated animal, or through a buyer-seller arrangement. Next, once companion animals have been regarded as pets, pet care extends to practices relevant to their health, nutrition, and everyday lifestyle. This is grouped together as '*quality of care*' and presented to participants as the second focal theme. Quality of care takes up the majority, if not entirety, of the pet care lifecycle; however, it does not mark its end. Similar to consumer journeys where a purchase is the target end behavior, end-of-life care of pets is deliberated as the final stage of the lifecycle. End-of-care may include burial, cremation and anesthesia, yet they are not central to the study. Instead, we select pet abandonment to represent the end state of the pet care lifecycle given its relevance to broader themes on resource constraints (Stavisky et al. 2017) and climate impact (Protopopova et al., 2021).

The proposed focal themes were validated against existing literature on their ability to influence direct desirable or harmful outcomes. For the purpose of this study, a desirable outcome refers to positive welfare benefits to the companion animal itself. On pet ownership, moral and ethical debates dominate existing studies, including the language around 'ownership' itself, which suggests that companion animals are 'owned' rather than 'kept' (Du Toit, 2016). For quality of care, quality of life assessments exist among veterinary practices (Mullan, 2015), yet welfare assessments by pet owners may still lack objectivity (Serpell, 2019). Pet abandonment offers



the clearest identification as an undesirable, negative outcome from a welfare perspective. When domesticated pets are abandoned, they experience a significant drop in welfare levels alongside increased health risks, such as in overcrowded shelters (Turner & Macdonald, 2012) or in stray populations (E Silva et al., 2025). Taken together, the selected themes are exhaustive for this study.

From here, participants continue through Step 2 to identify the full set of system variables. Using basic brainstorming strategies, each group was instructed to write ideas on sticky notes both individually and as a group. The final outcome was a universal set of variables aggregated across three groups. Based on this universal set, system variables were refined to group similar ideas together, and remove ones that are peripheral. If a variable is present in all three groups, it is included in the final set. During this process, two additional elements were suggested and agreed upon, namely '*adopt pet*' and '*buy pet*' to introduce an additional dimension to the system map. The resulting set of system variables totaled to 28 elements, which is still manageable for the workshop. Any additional element proposed or included by participants in the following steps were excluded from our analysis.

In Step 3, respective groups proceeded to map interconnections and identify causal links between variables, drawing on their formal or informal experiences and expertise. The conditions for drawing interconnections were explained to participants: links must be direct, and either promoting or encouraging (positive), or inhibiting or discouraging (negative) from one element to another. The magnitude of influence was not captured in this workshop to maintain the simplicity of the system map. During this process, co-facilitators played a central role in managing disagreements and helping reach a group consensus within the time allocated.

A modification to the PSM process was introduced at Step 4. Participants were invited to present their maps for validation at this stage, prior to identifying reinforcing loops and interventions. The purpose of this modification was to streamline and harmonize varying interpretations on system variables which arose during Step 3. In respective groups, the first draft of the CLDs were presented for participants to question, disagree or concur.

Steps 5 and 6 were combined together, where participants attempted to identify reinforcing feedback loops – which are chains of causal relationships that cycle back to their initial causes and amplify their impact – and possible interventions. At this juncture, groups identified nodes without any loop connections, suggesting possible peripheral relationships. At the end of the workshop, three system maps were produced and ready for further analysis.

Map digitisation and analysis

The system maps were manually interpreted and digitized based on photos and videos captured after the workshop. Each map is coded into a spreadsheet containing the nodes and edges. Due to observed differences and limitations during the workshop, the wording of selected elements were revised to better represent the actual interpretation observed across all three groups. For example, '*lack of funding*', was interpreted as personal finance by all three groups, rather than institutional funding to shelters, which had been the original idea proposed



in Step 2. Since this creates redundancy to another element, namely '*income*', a new element called '*resource*' was introduced, while the redundant elements were removed from the digitized map. Any causal links were maintained, and redirected to '*resource*'.

Open-source tools were evaluated to visualize the digitized maps. This includes open-source tools such as Gephi (Suno Wu et al., 2021) and Kumu (Bertscher et al., 2024). Manual recreation of the map using Vensim was also considered, however this method was ruled out due to the complexity of the maps. Instead, a custom script was developed using the Python package, NetworkX (Hagberg et al., 2007) due to its greater flexibility for performing network and causal flow analyses (Suno Wu et al., 2021).

Upon digitization, an integrated map is generated comprising all causal links aggregated across the three groups, and cited herein as the *full map*. The nodes are color coded based on its assigned sub-category: *outcome*, *owner factors*, *socio-cultural*, *governance*, *public infrastructure* and *external shocks*. The links are color coded based on its interaction: green (encouraging), red (discouraging), and black (both) with arrows to represent the direction of its causal influence. The black lines are a necessary refinement to address elements such as '*awareness*', which may encourage or discourage another element based on its value. Hence, a black arrow indicates that it may encourage or discourage another element if its value is high, and vice versa.

To simplify the full map, we refer to Suno Wu et al. (2021) for appropriate methods for analysis and sub-map extraction. The extraction of ego networks, which represent all incoming and outgoing connections related to a factor, is deemed appropriate for our use case with necessary modifications to our research objectives. Referred henceforth as the *reduced map*, all incoming and outgoing links related to our three focal elements and its immediate neighbors are retained. The objective of this map is to explore dynamics that influence the pet lifecycle, rather than independent outcomes. If a focal element was studied independently, the resulting network of complex relationships yields no clear feedback loops. Instead, interactions which intersect all three focal themes will help identify realistic, high-leverage interventions.

Literature on CLDs suggest that a variable may be endogenous or exogenous to the system, depending on the scope of the study; of which, the latter is not influenced by other variables in the system and are therefore external drivers (Haraldsson, 2004; Uleman et al., 2024). Therefore, we refine our analysis further to produce the third and final map by removing exogenous variables from the reduced map, referring it as the *endogenous map*.

During analysis, we adopt the COM-B model for behavior change to frame and differentiate elements in the map as capabilities, opportunities and motivations, which together can effectively influence target behavior (West & Michie, 2020).



Results and Discussion

Full Map

The integrated systems map comprises 27 elements and 91 causal links spanning three focal elements: *pet ownership*, *quality of care*, and *pet abandonment*. Of the causal links drawn, 70.3% were unique (i.e. drawn by only one stakeholder group), while 14.3% were highly concurred (i.e. drawn by all three groups) – highlighting varying stakeholder views. Each element is tagged as an outcome (22.2%) or one of five factors: socio-cultural factors (29.6%), governance factors (11.1%), public infrastructure factors (11.1%), owner factors (22.2%), and external factors (3.7%). A full list of encoded elements and their descriptions are provided in Appendix A.

Table 1 summarizes the incoming and outgoing links for the three focal elements. As outcome variables in the map, they are influenced by an average of 20 elements, reaffirming balanced input from stakeholders during the workshop with no clear bias towards a specific outcome. A thorough assessment of these relationships are explored under the reduced and endogenous map. Notably, the number of outgoing links is significantly lower, reaffirming our selection criteria for focal elements to be representative endpoints across the pet care lifecycle. Here, we can observe several preliminary insights on reinforcing loops. First, pet ownership and quality of care reinforce elements such as '*not having kids*' and '*welfare awareness*', and '*humanization*' respectively. Pet abandonment, by contrast, is found to influence only one element, namely '*shelter existence*', suggesting it marks the point at which care responsibility shifts from the owner to a third party. A full list of interconnections is provided in Appendix B.

Table 1. Number of interactions with focal elements

#	Focal Outcome	Incoming	Outgoing
I.	Pet ownership	20	3
II.	Quality of care	22	2
III.	Pet abandonment	19	1

Reduced Map

PSM results could vary greatly depending on facilitator effectiveness, mode of delivery, and participant knowledge and preparation (Kumar et al., 2026; Bertscher et al., 2024). Inputs from diverse stakeholders therefore require a further level of interpretation (ibid), which the reduced map makes possible. As described in our [Methodology](#), the reduced map is built around our three focal elements and their surrounding network, comprising 6 outcome variables, 17 factors – of which 10 are directly connected to the focal elements and 7 are one step further removed – and a total of 66 causal links.



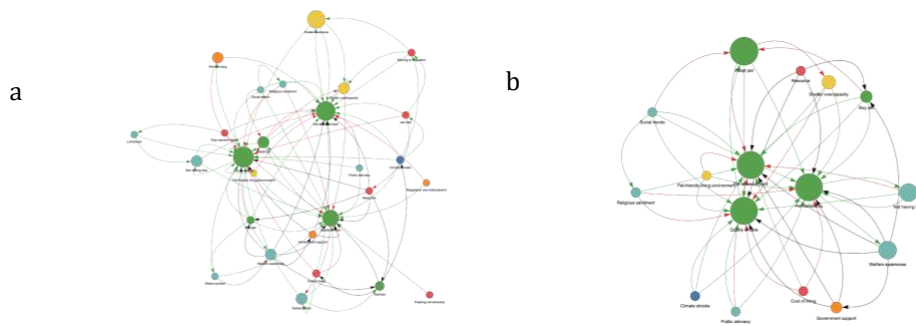


Figure 1. (a) full map; (b) reduced map

Socio-cultural variables, which reflect shared societal values, beliefs or norms, make up the majority of elements in the reduced map. Elements with direct relationships to the focal elements include lifestyle shifts such as '*not having kids*'; civic-oriented values, including '*welfare awareness*' and '*public advocacy*'; as well as cultural and religious values, such as '*religious sentiments*' and '*social trends*'. Given Malaysia's plurality in culture, ethnicity and income, these socio-cultural drivers exert a normative influence in the form of "social opportunities" driving pet owner behaviors. Social trends, notably, exert a strong influence and drive all three focal elements. This suggests that patterns of high demand and positive reception towards pet products and exhibitions domestically can be observed. A similar pattern appears outside of Malaysia: in Japan, for instance, social trends are found to drive extreme consumer attitudes towards infantilization and anthropomorphism, leading to poor welfare outcomes for their pets (Atherton & Moore, 2016). '*Religious sentiment*', in contrast, discourages both ownership and quality of care, reflecting a factor unique to Malaysia where views held by the Muslim-majority on dog keeping and interactions brings forth concerns of abuse and mistreatment (See, n.d.). Other socio-cultural variables, such as '*humanization*', '*loneliness*', and '*status symbol*', are also present in the reduced map, though they act as mediating variables rather than direct causes.

Endogenous Map

According to Richardson (2011), adopting an endogenous point of view is crucial to uncover the internal mechanisms that drive complex system behavior. Accordingly, our final map removes all exogenous variables or external factors that influence system behavior but originate outside its boundary (ibid). This produces a closed-loop system comprising 15 elements – 5 outcomes and 10 factors – and 51 causal links.

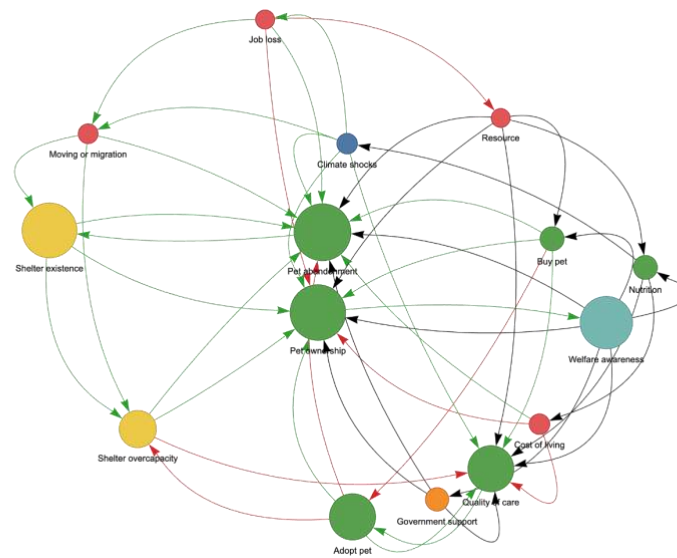


Figure 2. Endogenous map

While the full and reduced maps demonstrate the complexity of the pet care system, the endogenous map (Figure 2) reveals the internal feedback mechanisms relevant to answering our RQ2. In this map, climate shock is singled out as the sole external force in understanding risk to the pet care system. At the center of the endogenous map, 'resource' ties internal and external forces together: its availability, or lack thereof, is the only element in the map with a dual impact on all three focal elements. Depending on its magnitude (high or low), resource availability directly influences consumer behavior related to ownership and quality of care, and generates internal dynamics that can lead to undesirable welfare outcomes related to abandonment. Awareness of companion animal welfare is the only socio-cultural element remaining in the map, influencing not only the focal themes but also institutional actors. Its perceived value and potential for intervention are explored further in the next section.

As noted in Table 1, the sole outgoing link from pet abandonment is tied to 'shelter existence'. The endogenous map reveals a complex relationship resembling a vicious cycle between 'shelter existence' (also loosely interpreted as the demand or availability of animal shelters) and overcrowding. While these do not concern the consumer journey directly, the dynamics between abandonment and shelters are fundamental to a comprehensive understanding of companion animal welfare from start to end.

The maps presented thus far represent shared mental models held by Malaysian stakeholders on pet care, marking the first attempt to map pet care within a broader socio-ecological system. Based on these results, we explore thematic findings to offer a grounded interpretation and its implications for future pet care practices. Findings 1 and 2 addresses RQ1 by examining the internal factors or "opportunities" which drive consumer behaviors. Findings 3 and 4 addresses RQ2 by examining how climate shocks threaten the pet care system from a consumer and institutional lens. To understand the implications from a system-level perspective and potential

interventions, we turn to sub-maps showcasing the several reinforcing loops as an entry point for targeting interventions (Kumar et al., 2026).

Finding 1: Resource availability is a physical opportunity enabling pet care

As the world evolves and resources become less abundant, consumers must unlearn mental models such as the consumption mindset (White et al., 2019). A central thread emerging across all three focal elements is ‘resource availability’ – referring to one’s income and time, but primarily income – as a proxy for a pet owner’s consumption appetite. While normative factors influence desire for ownership, resource availability determines its viability. If pet ownership is perceived as unaffordable or even “impossible”, future owners may opt out from having pets entirely. The reverse also holds: as consumers experience an increase in purchasing power, the opportunity to own a pet resurfaces. Veevers (2016) shared perspectives on extravagant pet ownership to be a marker of affluence and tool for status-signaling; however, greater access to consumer credit may actually grant lesser affluent individuals the opportunity to match the consumption levels of more affluent peers (Ahlström et al., 2020).

Higher resource availability may encourage extravagant ownership behaviors, such as the purchase of luxury or designer breeds. Yet, lower resource availability does not encourage adoption outcomes: the decision to adopt may not be financially-motivated, consistent with existing literature suggesting that more people adopt due to welfare and humanization reasons (Butterfield et al., 2012).

From the perspective of care quality, the pet care system suggests that a baseline standard of care is assumed for any pet owner. However, the linkage to resource availability shows that resources can still shape an owner’s nutritional choices for their pets. For example, premium diets are marketed as high-quality, although one study on commercial dog food diets argues that super-premium brands may show high crude protein levels without higher digestibility, which is also important (Daumas et al., 2014). Nonetheless, these diets typically carry high price tags, making them less accessible for lower-income pet owners, who resort to less premium substitutes.



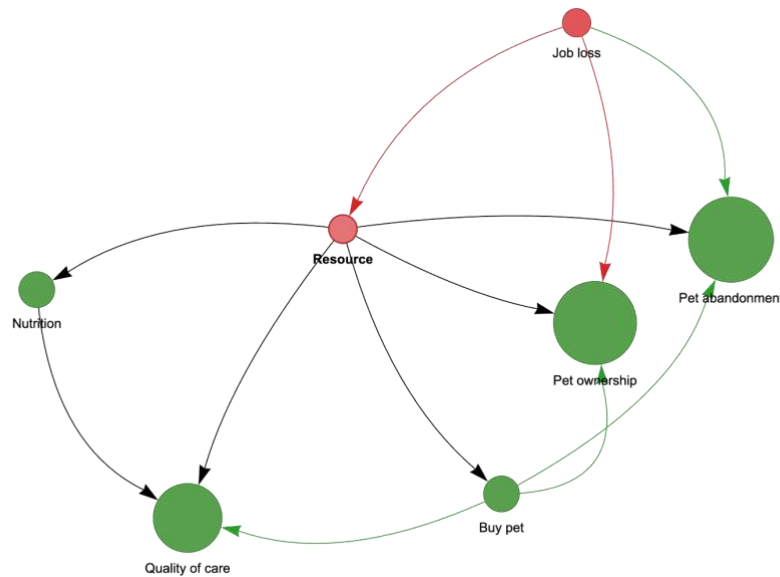


Figure 3: Impact of resource availability

The concern lies in that when resources run out or are no longer sufficient to meet the standards of care, pet owners may resort to abandonment to eliminate the burden. Leifer (2026) concurs this perspective, stating that the dramatic rise in costs associated with ownership due to inflation and housing costs in the United States was the reason for abandonment of pets.

Finding 2: Unsustainable consumption exposes pet owners to system vulnerabilities

Working is a necessity for most individuals to earn income, particularly within a capitalist economy (Lazear, 2018). Income increases resource availability, enabling a better quality of life for owners and their pets alike. However, the standard of living it sustains becomes precarious when earning potential is disrupted. Figure 4 visualizes the threat of job loss on one's resource availability, as well as its direct influence on ownership and abandonment. Several perspectives can be observed to describe its impact. First, individuals without a job are deterred from keeping a pet in the first place, though from a systems perspective may be a desirable outcome due to avoidable risks of abandonment. Second, job loss directly impacts a pet owner's life circumstances, rather than the pet itself. In times of economic downturn, pet owners may struggle to maintain housing and are forced to move, especially if there is a lack of affordable, pet-friendly options (Leifer, 2026).

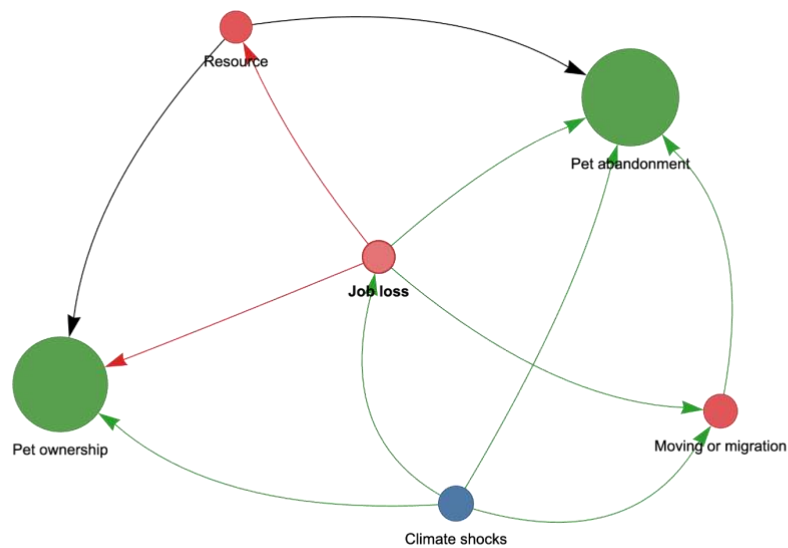


Figure 4: Job loss and resource stability

Moving is cited as one of the top reasons for abandonment (Lambert et al., 2019; Coe et al., 2014), though it may not always be triggered by job loss. Other possible factors include changes to housing rules on pet ownership or one's pursuit of opportunities in different geographical regions. In addition, affluent individuals may possess greater means for emigration; thus, high-income pet owners may relocate somewhere where bringing their pet is not an option. In these scenarios, despite having the resources to do so, all paths may still lead to pet abandonment, unless rehoming options are available.

Nonetheless, for the majority of pet owners, care systems operate under a degree of systemic vulnerability. While external factors are unavoidable, a review of consumption patterns is necessitated before reaching a point where pet care can become unsustainable.

Finding 3: Climate shocks are an imminent risk to care systems

Economic shocks are unpredictable events, causing sudden macroeconomic instability to countries worldwide. As the planet approaches its tipping points, climate shocks present an imminent force threatening many socio-ecological systems, including pet care. While the impact of climate change on pet welfare – notably, health – is well established (Protopopova et al., 2021), its impact to the pet care system as a whole is less direct.

Figure 5 shows how climate shocks can threaten system stability for pet care. First, they pose a direct threat to job and resource stability from a purely economic lens. One study estimates a 2.2 percentage point increase in unemployment in Malaysia, or 318,000 jobs by 2030 based on a 1-in-20-year flood scenario simulation (World Bank & Bank Negara Malaysia, 2024). Pet owners in climate-exposed sectors such as agriculture, or those in certain geographies which historically are prone to floods may be most impacted. As explored in Finding 2, job loss brings forth difficulties in sustaining personal livelihoods, including their pets'. Second, climate change

poses the threat of forced displacement: either permanent, due to irreversible environmental change such as rising sea levels, or temporary during emergency evacuations (Protopopova et al., 2021). This adds a further dimension to abandonment risks discussed in Finding 2, where climate shocks can directly trigger abandonment outcomes, even if resources are available.

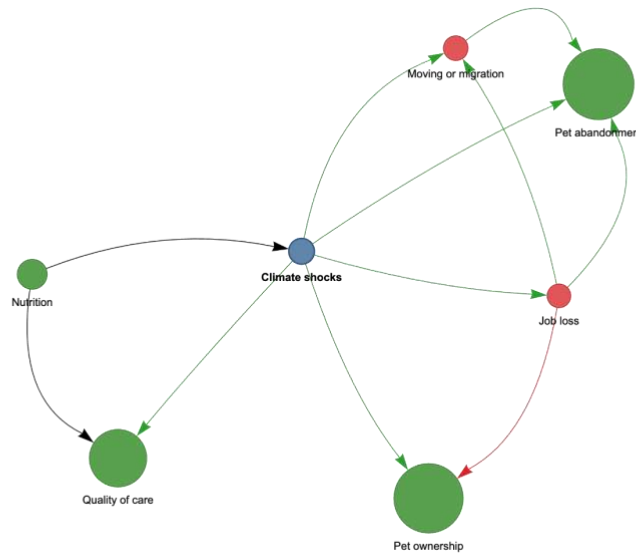


Figure 5: Impact of climate shocks

From a different perspective, a single incoming link to climate shocks suggests how providing better nutrition to pets may, in turn, contribute to climate change and exacerbate existing risks. Existing studies on the ecological footprint of pet food consumption shows that contribution from pets is increasingly significant with the rise of raw and human-grade diets, in addition to increasing pet population sizes (Okin, 2017; Protopopova et al., 2021). Thus, we frame Findings 1 through 3 within a consumer care system – where unsustainable consumption can create systemic vulnerability, exposed and intensified by climate shocks.

Finding 4: Institutional care systems could be on the verge of collapse

The role of institutional care is profound in that they assume responsibility for the continuity of care once pets are abandoned. Given that the pet care journey may effectively end at abandonment, the point at which responsibility shifts from the owner to a third party is primarily mediated by animal shelters.

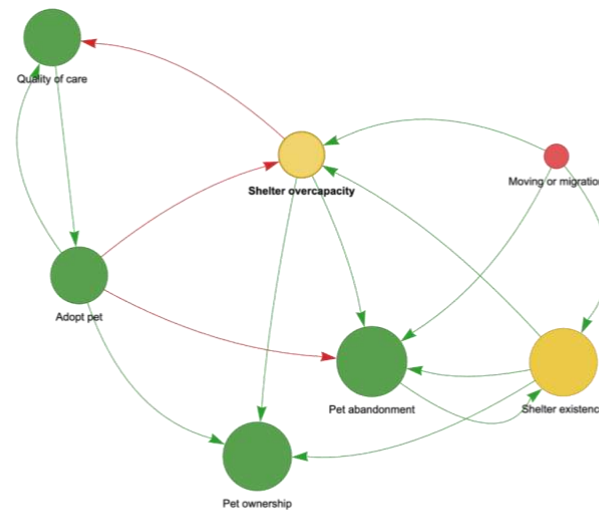


Figure 6: Shelter existence and overcapacity

However, animal shelters themselves are embedded in a vicious cycle that reinforces poor welfare outcomes (Figure 6). The existence of shelters inadvertently encourages abandonment, offering pet owners a readily available exit, rather than having to resolve their circumstances directly. Rather than finding rehoming options for their pets, pet owners could abandon pets to shelters, who bear the burden of finding adopters to free up capacity. However, adoptions are also not guaranteed, with the same external shocks discussed in prior findings contributing to shelter crises as well (Leifer, 2026; Stavisky et al., 2017).

When shelters reach capacity and can no longer accept abandoned pets, they are pushed towards stray populations for survival. For stray populations, welfare is low and highly dependent on altruistic acts from residing communities. Since unmanaged stray populations raise public health concerns (Munir et al., 2023), they may also be exposed to additional risks of mistreatment and abuse. One local report suggests how stray animals may even be dehumanized as pests and subjected to inhumane population control (Perimbanayagam, 2025).

Thus, as pet owners face potential disruption to their ability to sustain care, the resulting rise in abandonment places additional strain on institutions already operating near or over capacity. Across the globe, animal shelters remain largely donation-dependent with limited funding or resources. Without intervention, these systems risk collapsing under compounding pressure.

A Framework for Sustainable Pet Care

Based on these findings, we formulate a conceptual framework for sustainable pet care in Figure 7. This framework is intended to help actors within the pet care sector, including policymakers, understand companion animal welfare through the perspective of consumer and institutional care systems. By understanding the risk of system failure – namely, increasing

risks of abandonment leading to a collapse of institutional care systems under the threat of climate change – awareness and intervention efforts can be better targeted to themes surrounding sustainable consumption and resource allocations.

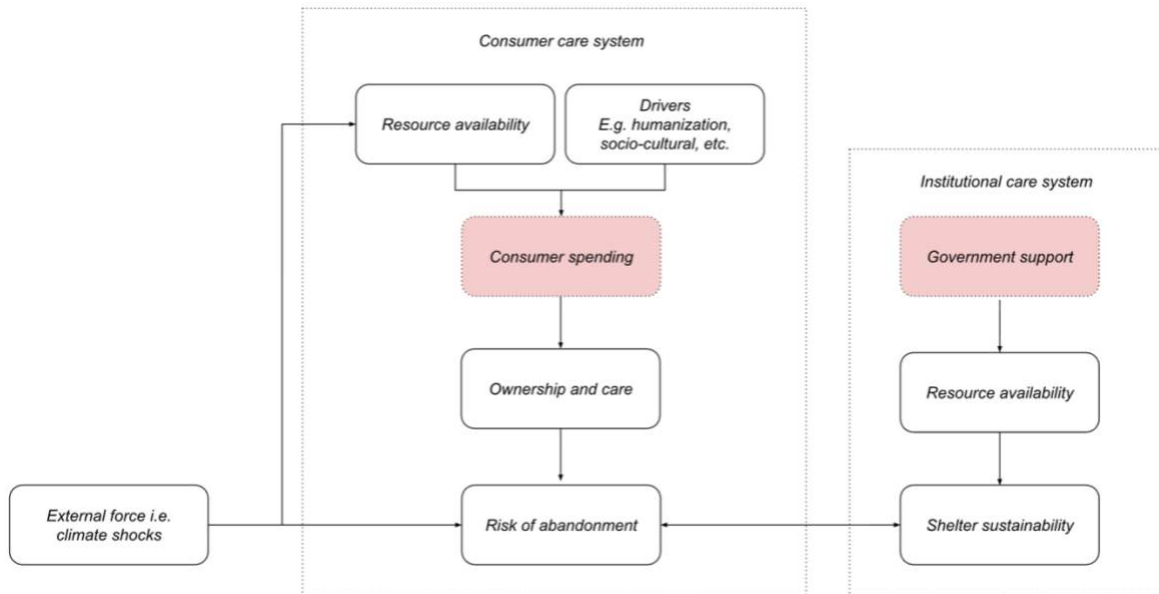


Figure 8: A framework for sustainable pet care

Education and awareness is cited as the most common intervention to deter abandonment outcomes (Lu et al., 2026; Lambert et al., 2019; Coe et al., 2014). Awareness objectives range from animal abuse prevention to worldwide movements to promote adoption, such as the “*Adopt Don’t Shop*” campaign (Lee, 2024), though they primarily revolve around themes of humanization. Nonetheless, they are equally effective in influencing public opinion; thus, our framework could complement existing strategies for awareness. Applying this framework to the Malaysian context, we therefore identify several implications and propositions:

- 1. Consumer-level interventions could target awareness on resource capacity and sustainable consumption.** Given Malaysia's strong cultural drivers around pet humanization, campaigns could extend beyond traditional messaging to actively challenge existing assumptions and perceptions of quality care. Continuous education on responsible ownership from the outset could also be increased, encouraging prospective owners to realistically assess their capacity to care for a pet to avoid risks of abandonment.
- 2. Budgetary allocation is key to reducing strain on traditional institutional care systems.** Prioritization of shelter resourcing through government funding or subsidies could help sustain existing donor-dependent models which the majority of institutional

care systems operate on. From a consumer lens, policymakers could consider expanding social assistance to pet owners facing pet food insecurities due to sudden, unexpected events. For instance, the creation of community pet food pantries across the United States are reportedly effective for struggling owners to cope, enabling them to not abandon their pets (Arluke, 2021).

3. End-of-care infrastructure could be diversified towards more sustainable models.

Given that abandonment is not fully avoidable, complementary models could look into distributed care networks, such as fostering and explore opportunities for paid care work through the labor market to increase care capacity, incentivize participation and reduce strain on traditional institutions.

4. Cross-sector collaboration between government, civil society, and industry is needed. This study demonstrates the wealth of insight that can be surfaced through collaborative methods such as PSM, where stakeholders across sectors are able to converge on shared drivers of ownership, care quality, and abandonment. A similar collaborative approach could extend beyond research into practice through coordinated interventions

Conclusion

The pet care system sits within a broader socio-ecological system, which is becoming increasingly important as Malaysia begins to observe growing pet populations. Using systems thinking, this study develops a conceptual framework for sustainable pet care, tracing how consumer-level vulnerability, driven by resource constraints and unsustainable consumption, will continue to strain institutional care systems to the point of collapse under the growing threat of climate change. As the first application of PSM to the pet care sector, the resulting maps and framework represent an initial and exploratory model of the pet care system. The causal relationships captured reflect stakeholders' shared mental models whose causal mechanisms can be empirically validated further in future research. Nonetheless, this study offers a starting point for understanding pet care through a systems lens and within the context of middle-income economies, with future research well positioned to build on this foundation.



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Appendix

Appendix A. List of encoded elements and their descriptors

No	Encoding	Element	Descriptor
1	T1	Pet ownership	The overall state of keeping or owning a pet
2	T2	Quality of care	Overall standard of physical, medical, and emotional care given to a pet
3	T3	Pet abandonment	The act of relinquishing or surrendering a pet
4	O1	Adopt pet	Acquiring a pet from a shelter, rescue, or rehoming source
5	O2	Buy pet	Acquiring a pet through a commercial transaction (breeder, pet store, online seller)
6	O3	Nutrition	Access to and quality of food provided to the pet
7	D1	Job loss	The loss of employment and subsequently income
8	D2	Climate shocks	Extreme weather or environmental disasters due to climate change
9	D3	Moving or migration	Events where owner relocates to a different location
10	D4	Welfare awareness	Public understanding or awareness of animal welfare issues
11	D5	Religious sentiment	Religious beliefs influencing attitudes toward animals
12	D6	Loneliness	Feelings of isolation and lack of companionship
13	D7	Shelter overcapacity	The state where animal shelters exceed their capacity to care for animals
14	D8	Cost of living	General expenses of personal living, including pet care
15	D9	Not having kids	The decision or state of not having children in the household
16	D10	Regulation and enforcement	Existence and enforcement of laws governing companion animal welfare
17	D11	Government support	Public subsidies, programs, or services aiding pet care
18	D12	Social trends	Societal shifts in attitudes related to pets
19	D13	Pet-friendly living environment	Availability of housing or spaces that accommodate pets
20	D14	Status symbol	The act of owning a pet as a marker of social status
21	D15	Resource	Financial, time, or material resources available to sustain pet care
22	D16	Humanization	Treating pets as family members
23	D17	Shelter existence	Presence and availability of animal shelters
24	D18	Pet licensing	Requirement to register or license pets with authorities
25	D19	Feeding convenience	Ease of accessing or providing food for a pet
26	D20	Public advocacy	Campaigns promoting animal welfare
27	D21	Poor owner's health	Owner's declining physical or mental health

Appendix B. List of interconnections

No	Source	Target	Direction
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1	T1	D4, D18, D9	increase
2	T2	D16	decrease
3	T2	O1	increase
4	T3	D17	increase
5	O1	T3, D7	decrease
6	O1	T1, T2	increase
7	O2	O1	decrease
8	O2	T1, T2, T3, D14	increase
9	O3	T2, D2, D8	both
10	D1	T1, D15	decrease
11	D1	T3, D3	increase
12	D2	T2	decrease
13	D2	T1, T2, T3, D1, D3	increase
14	D3	T3, D7, D17	increase
15	D4	T1, T2, T3, O2, O3, D11	both
16	D5	T1, T2	decrease
17	D5	T1, T3	increase
18	D6	T1	increase
19	D6	D9	increase
20	D7	T2	decrease
21	D7	T1, T3	increase
22	D8	T1, T2	decrease
23	D8	T3, D16	increase
24	D9	T3	decrease
25	D9	T1, T2	increase
26	D10	T3	decrease
27	D10	T2	increase
28	D11	T1, T2, T3	both
29	D12	O1	decrease
30	D12	T1, T2, T3, O1, D5	increase
31	D13	T3	decrease
32	D13	T1, T2	increase
33	D14	D4	decrease
34	D14	T1, T2	increase
35	D15	T1, T2, T3, O2, O3	both
36	D16	T2	decrease
37	D16	T1, T2, O3	increase
38	D17	T3	increase
39	D17	T1, D7	increase
40	D18	T1	decrease
41	D18	T3	increase
42	D19	T2	increase
43	D20	T3	decrease



44	D20	T1, T2	increase
45	D21	T2	decrease
46	D21	T3, D6	increase

