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Knowledge Management Practices and Cultural Heritage Conservation in Modern Societies

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ABSTRACT: In modern-day societies cultural heritage conservation has moved beyond a technical and custodial activity towards one that relies on knowledge, and involves systematic identification, documentation, preservation and dissemination of tacit and explicit knowledge. This article reviews the cross-overs between knowledge management (KM) and the cultural heritage (CH) conservation, and analyses the application of the well-known KM frameworks, such as the tacit/explicit distinction, the SECI model for knowledge conversion on the safeguarding of tangible and intangible cultural heritage. Inspired by recent studies in bibliometric and information-systems literature and heritage management literature, the review will illustrate the exigencies of knowledge and information that make the use of structured knowledge-sharing architectures essential to good conservation practice today, and the need for connections between heritage professionals, holders of indigenous knowledge, digital archives, and the communities that produce them. Specific practices in knowledge management in the sector are reviewed, such as knowledge management systems for heritage projects, information and documentation in digital form and application of semantic knowledge architectures, bibliometric and scholarly knowledge tools, and the capacity to integrate indigenous and CSI with formal conservation and science knowledge systems. It also explores the complexities of sharing knowledge with heterogeneous stakeholders and their epistemological viewpoints; the potential marginalisation of indigenous knowledge in favour of institutionalized knowledge; and the geographical unevenness in the production of heritage knowledge. The article suggests that a pluralistic approach to knowledge management recognizes both indigenous and community-level knowledge as well as scientific and digital knowledge and conservation practice in a formal manner, allowing neither of these types of knowledge to be subordinate to the others, but a pathway for future research on the governance of knowledge in a pluralistic way in heritage management.

1. INTRODUCTION

Cultural heritage, tangible (monuments, archaeological sites and artefacts) and intangible (oral traditions, crafts, ritual practices) includes a cumulative record of human knowledge, which is in constant danger of loss due to conflict, urbanisation and the loss of generations who carry the knowledge. The work of conserving this heritage is traditionally seen as a technical and scientific task focusing on the physical stabilisation and the conservation of objects/sites. However, in contemporary societies, conservation practice is increasingly defined as a knowledge issue: heritage is not protected unless the knowledge field to understand, interpret, and preserve heritage is identified, captured and passed on across professional, institutional and generational boundaries. The duty of identifying, protecting, conserving and passing down cultural and natural heritage to the next generation can also be formally defined in international law, as the UNESCO Convention on the World Heritage (Convention 1972), explicitly frames the function of conservation as one of taking appropriate legal, scientific, technical, administrative and financial measures, a framing that anticipates the knowledge-centred view of conservation this article develops.

With its systematic approach to the production, collection, dissemination and utilization of organisational and community knowledge, knowledge management (KM) provides an important analytical framework to consider cultural heritage conservation. The organization of cultural heritage projects is usually challenging given that they involve several both heterogeneous and often conflicting ontological and epistemological perspectives, in addition to having to share knowledge on the cultural heritage objects with the people involved. The article summarizes the ways knowledge management applies to the field of cultural heritage conservation, based on literature in information systems, bibliometrics and cultural heritage studies in recent years. Section 2 will briefly highlight the methodology that was adopted in the conduct of this review, Section 3 will examine the theoretical aspects of knowledge management as applied to the heritage sector, Section 4 will address specific issues of knowledge management practice and Section 5 specific aspects of the outcomes and benefits of these practices for heritage conservation. Section 6 will provide a discussion of the problems encountered as part of the work and Section 7 will cover the discussion on the findings. Section 8 will present the recommendations for practice and future research.

2. RESEARCH METHODOLOGY

This article employs narrative-integrative review approach appropriate for synthesising a literature from the foundational knowledge management literature, the bibliometric analysis of heritage scholarship, information-systems design for heritage projects, and indigenous knowledge governance. It does not present a formal systematic review for each of these components, or a meta-analytic review that pools findings from the different pieces of evidence, but rather it draws together the fundamental knowledge management frameworks and the emerging published bibliometric and systematic review evidence on heritage research, empirical evidence on specific knowledge management systems and practices. The literature search used various keywords in the databases, such as Scopus, Web of Science and Google Scholar, while the tools used for manual search were reference lists of foundational works in knowledge management literature, as well as and subsequent works in cultural heritage knowledge management that were used to trace the core knowledge management literature and more recent works in heritage.

Sources were prioritised based on the three criteria of theory-centrality from the knowledge management constructs that throughout the review, tacit-explicit distinction of Davenport and Prusak (1998), the SECI model of Nonaka and Takeuchi (1995) and the knowledge management systems taxonomy of Alavi and Leidner (2001); empirical or design-science rigour – particularly favouring peer-review papers that evaluate actual heritage knowledge management systems; and breadth of epistemological perspective – with an intentional effort to include literature on indigenous and community-based knowledge systems, as well as literature on institutional and digital km systems, so as not to repeat the very marginalisation of indigenous knowledge that several of the sources sought to address. From the collected studies, only those that had implications on knowledge management theory or practice focusing on cultural heritage, the documentation of heritage knowledge by multiple players, or the interaction between indigenous and scientific knowledge in contexts of conservation were discussed in detail; those not focused on knowledge management in any other organisational domain, but merely on the physical or scientific conservation of cultural heritage, or those without a dimension of knowledge management, were not. The synthesis is organized thematically starting with theoretical background of KM as applied to KMH followed by specific KM application in heritage, the documented results of these applications, and the individual KM structural challenges that affect whether they are effective and are organized towards the end for the practical and research implications it will lead to in the discussion and conclusion parts of the review; this structure builds up the review as it sweeps behind the scholars.

3. LITERATURE REVIEW

3.1 Knowledge Management Foundations: Tacit and Explicit Knowledge

In terms of the Knowledge Management scholarship, explicit knowledge refers to knowledge that is codified, documented, and documented with formal channels like manuals and databases, while between this and what's more difficult to articulate and give is tacit knowledge. Davenport & Prusak (1998) defined organisational knowledge as a "fluid combination of experiences, values, context and expertise that offers a schema for the assessment and digestion of new ones", highlighting the need to examine the characteristics of much heritage-related expertise in highly contextual and experiential terms. The widely known SECI model of knowledge conversion developed by Nonaka and Takeuchi (1995) is represented by a sequence of the four processes: socialisation, externalisation, combination and internalisation, in which the tacit knowledge is made involved, explicit, and then re-internalised as a new tacit understanding in organisations. It is especially relevant to cultural heritage conservation since much of heritage knowledge in the form of traditional craftsmanship techniques, even hand-to-hand tales, ritual practices, and traditional building systems are tacit and under great threat of loss as they are more likely to be held by ageing practitioners or the 'indigenous people' or 'heir of the people' who hold the knowledge for themselves, and therefore cannot be passed on unless brought to the attention of a third party and documented by them.

In an influential review of knowledge management and knowledge management systems, Alavi and Leidner (2001) further differentiated the various approaches to knowledge in organisations—as a state of mind, as something, as a process, as a condition of access to information, and as a capability—and suggested that the design of a knowledge management system should be based on an understanding of which approach to knowledge is predominant in that particular context. In the context of heritage conservation, this means that the design for a knowledge management system, aimed at preserving tacit knowledge of craftsmanship or ritual knowledge, is considerably different than that for a system that would only preserve and retrieve explicit catalogue information: the design of the former has to encompass systems for ongoing socialization and observation, while the design of the latter can mostly be based on codification and search.

3.2 Knowledge Management as a Lens for Heritage Scholarship

In recent years, the study of cultural heritage has been the subject of bibliometric scholarship, which looks at cultural heritage research as a type of knowledge production that entails active management. Vlase and Lähdesmäki (2023) conducted a bibliometric analysis of 1,843 journal articles about cultural heritage listed in the Web of Science from 2003-2022, and found that the number of articles has increased significantly over time, but that most articles have been published by very few, highly prolific writers and institutions, and most of these are found in Europe. Their analysis also identified a group of themes around heritage professions and conservation that, together with extra thematic groups concerned with cultural change and tangible cultural heritage (such as crafts) and community empowerment and cultural expression, embedded a scholarly knowledge base on heritage that is also disconnected and split into disciplinary and thematic strands, reflecting the split into strands observed in practice.

3.3 Knowledge Management Systems for Heritage Projects

Cultural-heritage projects have been studied phenomenon explicitly as knowledge-coordination problems and cases with required 'information-system support. While humanitarian action is traditionally considered to be facilitated by information-systems solutions, traditional socio-technical approaches to information-systems design, approaches rooted in fixed procedures, have been found to be inadequate for cultural heritage projects because heritage experts and technologies are not simply technologisable and reifiable elements but rather they are overlapping sociomaterial articulations that are continuously discovered and realized through interaction and socialization in their contexts (Arévalo, González, Beltrán and Nieto 2023). Investigating a design-science approach, they proposed a knowledge management system for cultural heritage projects and found valuable benefits from evaluation: the system could help to facilitate access to, and visualisation of, knowledge, it could enable more flexibility in knowledge sharing, and it could support informed project stakeholders decisions making.

From the digital collection management perspective, Dragoni et al. (2017) presented an abstraction of a Knowledge Management architecture specifically designed to address the entire digital lifecycle of a cultural heritage collection in a gallery, museum and an archive, such as collaborative curation, multilingual interpretation to bridge different language requirements of the various stakeholders involved in the international agenda, and the exposure of structured heritage data to human users and automated systems via machine translation and linkage to general purpose Knowledge Bases. As a demonstration of the

possibilities of designing KM systems for heritage, their architecture is used here to illustrate how such a system could be considered an active infrastructure designed to continuously enrich and interlink the heritage with the emergence of new knowledge.

3.4 Indigenous Knowledge Systems and Contemporary Conservation Practice

Another, growing line of research looks at the linkages between indigenous knowledge systems and formal, scientifically-based conservation methods. More recently, a great body of scholarship has focused on the need to deliberately promote convergence of indigenous knowledge systems and the formal approaches to cultural heritage management in order to avoid a marginalisation of indigenous and traditional approaches which has rendered conservation work so far (mostly) piecemeal and inadequate work; convergence has been called for instead of assimilation. This view aligns with other indigenous knowledge scholarship from southern Africa, such as Mugambiwa (2018) who, in his study of adaptation strategies in rural areas of Mutoko in Zimbabwe, argues that indigenous knowledge systems (IKS) have historically helped people in the region to respond resiliently to environmental and resource pressures; and Mutasa (2015), which explores the marginalisation of indigenous knowledge in formal disaster and resource management discourses, explicitly calls for the 'marriage' of indigenous and scientific knowledge, rather than the assimilation of one into the other or the separation of Scientism from indigenous knowledge per se. Building on the argument, Mugambiwa (2021) went on to argue that indigenous knowledge systems represent a sub-class of context specific epistemology that can underpin sustainable governance arrangements that are legitimate from within the local community, far beyond what can be accomplished by externally imposed scientific approaches. As seen in the above literature, indigenous communities often carry place-specific ecological and cultural knowledge which have collectively developed over the years and sustained cultural heritage sites and practices, and must integrate indigenous knowledge systems into higher education curricula and make it accessible to public knowledge and awareness programmes to institutionalise and facilitate the preservation and recognition of their knowledge alongside scientific and archival resources and expertise.

Figure 1. Conceptual Framework of Knowledge Management Practices and Cultural Heritage Conservation in Modern Societies



Source: Developed by the authors based on Nonaka and Takeuchi (1995), Davenport and Prusak (1998), Alavi and Leidner (2001), Nova Arévalo et al. (2023), and related cultural heritage literature.

From this literature, a conceptual framework has been built (see figure 1). The framework incorporates the SECI model of knowledge conversion and tacit vs. explicit knowledge axis, to elaborate the role of knowledge management in sustainable cultural heritage conservation. It demonstrates how documentation systems, digital knowledge architectures, knowledge sharing platforms, integration of indigenous knowledge, extracting knowledge in multiple languages and emerging digital technologies enable knowledge creation, preservation and dissemination. Every of these processes brings benefits to the effectiveness of the conservation process, community participation, knowledge retention, and cultural sustainability while also taking account of technological, institutional, community and policy factors.

4. KNOWLEDGE MANAGEMENT PRACTICES IN CULTURAL HERITAGE CONSERVATION

4.1 Documentation and Digital Knowledge Architectures

Systematically and digitally recording tangible and intangible heritage is a basic practice in KM that is fundamental when dealing with particular heritage conservation cases. This is being achieved with three-dimensional scanning, photogrammetry, multispectral imaging and even with semantic knowledge architectures structuring the heritage data for future long-term preservation, on-going sharing among several institutions, and for multilingual access. This approach was first exemplified by De Luca, Busayarat, Stefani, Véron, and Florenzano (2011) and they developed a semantic based platform for digital analysis of archival heritage that directly connects a structuring representation of a building with the analytical and historic documentation related to it, enabling conservators to flow between the physical structure and its built knowledge base. These digital architectures are not only used for storing data but also for enabling the entire knowledge life cycle of heritage storage, collaboration, multi-lingual interpretation to bridge language divides between the international actors and access of structured heritage knowledge to human and artificial actors.

At continental level, Isaak and Haslhofer (2013) introduced the Europeana Linked Open Data pilot that collects open metadata from millions of cultural heritage content across Europe that is made available under an open licence to be linked to other sources of information on the web, such as geographical information and thesauri. The project demonstrates how knowledge management principles can not only be used in a single heritage institution, but also across an international network of institutions, establishing a semantic infrastructure for cultural heritage knowledge, which would not be established by a single institution.

4.2 Knowledge Sharing and Coordination Systems

Starting from Nova Arévalo et al.'s work on design-science (2023), specific knowledge management systems have already been created for supporting the coordination of the different and diverse actors that are operating in the framework of cultural heritage projects. These systems are explicitly embedded in international governance frameworks and the framework of knowledge sharing in cultural heritage projects has been connected to the five international heritage policy objectives of credibility, conservation, capacity building, communication, and community engagement, often referred to as the 'Five Cs', are principles these knowledge-management systems need to implement in practice.

4.3 Bibliometric and Scholarly Knowledge Management

From a researcher perspective, the tools included in the Web of Science, for instance, and VOSviewer serve as knowledge management tools that can help the heritage research community understand the patterns of scholarly collaboration, uncover themed clusters and chart gaps in the intellectual landscape of the discipline. Vlas and Lähdesmäki (2023) showed that these tools not only cast light on what is known in heritage scholarship, but also on its unequal production and dissemination, as collaboration in research was seen to take place mainly within small scientific groups from the same institution, far from international scholarly networks, despite conditions being favourable with regard to the international networks of research collaboration and the increased influence that this brings to scholarly output.

4.4 Integration of Indigenous and Community Knowledge

An additional practice is the purposeful linkage of indigenous and community-based knowledge into formal conservation planning processes by participatory documentation, the creation of community-based knowledge inventories and the inclusion of oral history and customary practices into formal conservation planning documents. This practice explicitly works against devaluation, or externalization of tacit, communally acquired knowledge into explicit, transferable languages without detracting the knowledge from its cultural authority or context, while also making sure that the explicit knowledge is put in a

form that remains usable to the communities whose tacit knowledge it is derived from. A review of technologies for intangible cultural heritage has also reached the same conclusion that the capture and analysis technologies needed to capture the knowledge embodied in live cultural expression and practice, as found in traditions such as traditional song, dance and crafts, must be shaped in the form of responsive technologies, rather than technologies that are tailored to the traditional documentation technologies of texts or still photographs, acknowledging that knowledge of this kind is the most resistant to conventional documentation (Alivizatou-Barakou et al., 2017).

4.5 Multilingual and Multialphabetic Knowledge Extraction

A specific technical problem area for the digital knowledge management for heritage conservation is the multilingual and multialphabetic aspect of many of the world's heritage documents. Bergamaschi et al. (2022) describe the DigitalMaktaba project in which they created an automated workflow for extracting semi-structured syntactic, linguistic and cataloguing metadata for archival heritage documents in non-Latin scripts such as Arabic, Persian and Azerbaijani, to support the creation, management and cataloguing of archival heritage collections that are typically manually and language-specifically processed. This book demonstrates that cultural differences in the conceptualization of “knowledge” (as outlined above) is not the only challenge for the application of knowledge management in culturally diverse heritage settings; the challenge of linguistic and script diversity is also a real technical issue, one that standard knowledge extraction tools that are focused on the manipulation of words in an alphabet that draws on Latin letters are not equipped to handle.

4.6 Industry 5.0 and Emerging Technological Approaches

Torroja's work has been extended in more recent literature focusing on the capacity of new technological paradigms broadly labelled as Industry 5.0 to improve BC process, as a result of the recent shift towards a renewed human-centred and sustainable approach to the management of built cultural heritage. After conducting a systematic literature review, following the PRISMA methodology, Jiménez Rios et al. (2024) found that Artificial Intelligence and Digital Twins are the technologies most studied as tools for built heritage conservation, and sustainability is widely explored in literature but resilience and human-centrism are comparatively under-studied and require additional research and implementation. They also reported that in many of the nations surveyed, there were still no complete information systems for collecting, preserving and sharing cultural heritage knowledge, and that countries in the Global South are poised to receive significantly from the early deployment of the "Industry 5.0" conservation models.

5. OUTCOMES OF KNOWLEDGE MANAGEMENT FOR HERITAGE CONSERVATION

5.1 Improved Coordination and Decision-Making

Evaluation of dedicated heritage knowledge management systems has been undertaken quite empirically, which has shown measurable gains in project coordination. Formal KM infrastructure has potential to directly overcome the flaws in accessing and visualising knowledge among project stakeholders, increase flexibility in knowledge sharing across the project network, and help with more informed project decisions, as described by Nova Arévalo et al. (2023).

5.2 Preservation of Knowledge at Risk

When knowledge management systems are used to make tacit elements of the heritage explicit and durable like traditional craft in records or oral statements in writing, then the risk of lost knowledge, attributable to ageing or death of the knowledge holders, is directly reduced. This result is in line with the logic given by the SECI model where the externalisation step of the conversion of knowledge is exactly the moment when fragile tacit knowledge becomes robust knowledge that can be communicated and reused from one generation to the following and from one institution to another. In this sense, the work done by Alivizatou-Barakou et al (2017) on intangible heritage technologies is very relevant as it highlights that documentation in text is not enough to preserve embodied and performative knowledge, requiring some technology specifically dedicated to capturing them.

5.3 More Equitable Knowledge Governance

Research on the relationships between indigenous knowledge systems and mainstream conservation science has argued that the formal recognition of community and indigenous knowledge, not as an alternative to the conservation science of experts, but as a part of it, leads to more sustainable and culturally legitimate conservation practices and results. The reason for this is that strategies that marginalise the perspective of the communities from which heritage comes have been discovered to be disjointed and ineffective in supporting long-term custodianship or cultural continuity, while strategies which engage these communities

in knowledge documentation and decision-making are more likely to achieve these two outcomes. Institutions to synthesize the two streams of knowledge: indigenous and scientific knowledge, instead of one superior to the other, as proposed by Mutasa (2015), seems to create a framework of knowledge that, over the long term, is able to sustain indigenous heritage more effectively than one single stream.

6. CHALLENGES IN APPLYING KNOWLEDGE MANAGEMENT TO HERITAGE CONSERVATION

With regard to the implementation of knowledge management practice to cultural heritage conservation, there are several structural problems that need to be addressed. One of the first challenges is the often considerably different ontological and epistemological viewpoints of the different stakeholders involved, whether this be conservators, historians, archivists, or indigenous communities or government bodies. Second, the geographic emphasis of heritage research and funding, mainly within the limited number of institutions based in Europe, may also generate a not representative knowledge base on heritage, and exclude areas like South Asia and sub-Saharan Africa where a comprehensive national heritage information system is poorly developed. Third, the constant danger of marginalising indigenous and traditional knowledge in favor of institutionalized and scientific knowledge endangers the completeness and legitimacy of the bases of the heritage knowledge. Lastly, much of the World-Heritage documentation is also multilingual and multialphabetic, offering digital knowledge extraction and cataloguing systems primarily adapted to Latin-alphabet text processing a long-term technical challenge, as for the case of DigitalMaktaba and other projects supporting non-Latin archival resources.

7. DISCUSSION

According to the reviewed literature, cultural heritage conservation in modern societies rests more on intentional, structured knowledge management than on ad hoc knowledge transfer, as in the past. A theoretical perspective on why some forms of heritage knowledge are fragile is provided by the SECI model, which says that when knowledge is never externalised from tacit, embodied skill, to explicit, documented forms, then there is always a risk that the knowledge carrier(s) may die out before it could be transmitted. Simultaneously, the evidence examined here indicates that externalisation, alone, cannot be achieved; knowledge management systems need to enable continuous coordination among the various and diverse players involved to also incorporate, and not underplay, Indigenous and community knowledge into the mainstream of conservation science.

The second implication relates to the issue of the uneven geography of heritage knowledge production which was identified by Vlase and Lähdesmäki (2023). Much of the academic and institutional knowledge relating to the conservation of cultural heritage is still relatively knowable only in a few countries and institutions, meaning knowledge management strategies used in other contexts may employ frameworks and tools that were not created to cater to the local context of cultural heritage, for instance. Such arguments prove that from a cultural, regional, and linguistic perspective, the transfer of certain knowledge management systems and practices should be taken with a pinch of salt and future implementations need to take cognizance of the local knowledge systems, their languages, and the rules and regulations in place at the local level rather than adopting them in their entirety. The result of the literature consultation on indigenous knowledge in Section 2.4 further confirms that core knowledge governance aspects for the European institutional context cannot be directly transferred to a context in which community-based knowledge traditions are orally transmitted.

8. CONCLUSION AND RECOMMENDATIONS

Theory, practice and challenges of knowledge management practices in the context of cultural heritage conservation have been reviewed in this paper, discussing theoretical bases such as tacit/explicit knowledge distinction, SECI model, Knowledge Management Practices (KMPs), digital documentation architectures, dedicated Knowledge Management (KM) systems, bibliometric knowledge tools, multilingual knowledge extraction, and integration of indigenous knowledge practices. From the evidence presented, it appears that an effective and sustainable heritage conservation in contemporary societies relies on knowledge management strategies that are more than merely the digitisation and storage of heritage information but on a participatory process of coordination between different and heterodox actors as well as on a formal and respectful inclusion of the knowledge and practices of indigenous communities and local people as equal partners with that of institutions and the scientific community. Knowledge management systems in heritage institutions and policies are encouraged that are participatory, co-ordinated at stakeholder level, more than just providing technical documentation, and encourage internally to develop comprehensive national heritage information systems in locations where the practical application of such systems is not reasonably developed.

Comparative studies that can examine knowledge management systems for heritage conservation in different cultural and regulatory environments other than the European ones now prevalent in the literature and papers, and further empirical studies testing participatory methods that formally include indigenous knowledge governance in the design of heritage information-systems would all benefit future research.

Looking beyond these direct lines of research, the implications of this review are that future developments of novel digital technologies will likely impact the enterprise of knowledge management, which underpins the efforts of heritage conservation. Beyond the SECI-cycle discussed throughout this review, as generative AI and large scale digital twins are able to represent, reconstruct and even simulate plausible heritage elements and assets that are damaged or lost, a new knowledge-governance question is emerging: how can these digital, if not AI anachronisms be traced back and established as the real thing – and how can original observation, or testimony, be separated from the copies in a way that ensures their own authenticity? Extending the epistemic perspective on knowledge management introduced here would immediately be a natural, and sensible, follow-up to future investigations concerning the epistemic status of AI-generated heritage reconstructions and how to prevent such reconstructions from becoming "knowledge" or being confused as such or replaced by primary knowledge.

There are more general policy and institutional implications of these goals for the future. International heritage organizations and funding sources may be able to support future investment in comprehensive national knowledge infrastructure in the regions of the Global South where heritage resources are concentrated, by Jiménez Rios et al. (2024) identified to be well positioned to benefit from early adoption of Industry 5.0 – heritage conservation approaches, as opposed to placing its increasing burden in already richly resourced European institutions. In governance, in the face of the growing recognition of national and international heritage policy of intangible heritage and community-held heritage, future policy frameworks could include rights management, consent processes and benefits frameworks that regulate the documentation, digitisation and dissemination of indigenous and community heritage outside its formal community, but in ways that do not reiterate further acts of dispossession. But more emphasis on the resilience of shared heritage knowledge infrastructure against at-risk technologies, old models and infrastructure, and on future research and policy needs for technology interoperability, long-term funding for digital preservation, and how today's investments in knowledge management will work for heritage conservation into the future, would help ensure that the knowledge asset management investments we make today will play a more active role in meeting the goals of conservation than in becoming a form of at-risk heritage.

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