Universidad de Huelva

Departamento de Economía Financiera, Contabilidad y Dirección de Operaciones

Social media and open source intelligence (OSINT) in Andalusian local governments: the cases of Instagram and Twitter

Memoria para optar al grado de doctor presentada por:

David Perea El Khalifi

Fecha de lectura: 28 de mayo de 2021

Bajo la dirección de los doctores:

Enrique Bonsón Ponte

Tomás Escobar Rodríguez

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SOCIAL MEDIA AND OPEN SOURCE INTELLIGENCE (OSINT) IN ANDALUSIAN LOCAL GOVERNMENTS: THE CASES OF INSTAGRAM AND TWITTER.

REDES SOCIALES E INTELIGENCIA DE FUENTES ABIERTOS (OSINT) EN LOS GOBIERNOS LOCALES ANDALUCES: LOS CASOS DE INSTAGRAM Y TWITTER.

Memoria presentada por **David Perea El Khalifi** aspirante al Grado de Doctor con mención de "Doctor Internacional"

Thesis submitted for the degree of Doctor of Philosophy and the "International Doctor" mention

Directores:
Dr. Enrique Bonsón Ponte
Dr. Tomás Escobar Rodríguez

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Jose Luis Borges: *¿Por qué publicamos lo que escribimos?*

Alfonso Reyes: *Yo comparto su perplejidad y he dado con la solución:*

para no pasarnos la vida corrigiendo los borradores.

Dialogo

"Everyone knows that in research there are no final answers,

only insights that allow one to formulate new questions."

Salvador Luria

A ellos, abuela y abuelo. Así de eternos.

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ABSTRACT

SOCIAL MEDIA AND OPEN SOURCE INTELLIGENCE (OSINT) IN ANDALUSIAN LOCAL GOVERNMENTS: THE CASES OF INSTAGRAM AND TWITTER.
By David Perea

The use of communication channels represented by social media is a continuous trend in all areas. Its widespread adoption by both individuals and private and public organisations is undeniable. The evolution of new information and communication technologies with smartphones has led public administrations to consider other communication strategies. Some are more flexible than traditional media and are able to reach a wider audience and different stakeholder groups in a more immediate way. In particular, for local governments, social media networks play a key role in enabling them to get closer to their citizens, and should therefore be investigated further. Public institutions must be at the service of the citizen, and citizens are on social media. In order to contribute to the research in this area, the objective of this empirical study was to analyse citizen engagement on Twitter and Instagram with the governments of the users' municipalities and to analyse the dissemination practices of municipalities who respond to the demands of their citizens via these social media platforms. For the purposes of this research, most of the municipalities of Andalusia (Spain) have been analysed. All of this analysis has been carried out using Big Data techniques with Open Source Intelligence tools (OSINT), which makes it possible to investigate a large volume of data by taking into account all of the information generated on Twitter and Instagram by all of the publications (N = All) of the local governments. In this way, through this potential methodology, having all the data provides evidence that is closer to the reality of debates about social media in public administration. For both academics and professionals in the field provide valuable interpretations of how the functionalities of social media are not being used by local governments, that do not publish those that the citizens demand, as in the case studied, which deals with environmental disclosure. The findings of this original study can be placed in the context of broader debates in the social sciences. The need for more innovative and ambitious research is emphasised; with methodologies in line with current technological advances that make it possible to work with a considerable volume of data to advance the most accurate interpretations of social and technological changes in today's society. Thus expanding the research to multiple regions and integrating the findings in order to establish more effective and efficient communication strategies.

Table of content

CHAPTER 1

TWITTER AS A TOOL FOR CITIZEN ENGAGEMENT: AN EMPIRICAL STUDY OF THE ANDALUSIAN MUNICIPALITIES **50**

CHAPTER 2

CITIZEN REACTIONS TO MUNICIPALITIES' INSTAGRAM COMMUNICATION 83

List of figures

List of tables

x

RESUMEN y CONCLUSIONES
en español

12

Introducción

Las redes sociales como medio de comunicación están siendo cada vez más utilizadas en todos los ámbitos, siendo evidente la constante penetración de las redes sociales, ya que resulta que muchos métodos para compartir información han sido subsumidos por plataformas gigantes de redes sociales que tienen una velocidad y alcance increíbles (Merchant & Lurie, 2020). La penetración de las redes sociales es del 49% de la población mundial (We are social & Hootsuite, 2020), por lo que prácticamente la mitad de la población global (3800 millones de personas) utiliza una o más redes sociales para cargar y compartir publicaciones sobre actividades diarias, y a la vez también para informarse e interactuar (Șușnea & Iftene, 2018).

En la administración pública no son ajenos a este escenario. Las redes sociales ofrecen a los gobiernos un nuevo enfoque para la buena gobernanza en el sector público, al poder aumentar la transparencia pública y la rendición de cuentas (Bonsón *et al.,* 2012) y al poder crear un canal de comunicación bidireccional entre ellos y sus ciudadanos (Mergel, 2013).

Con base en las premisas anteriores, el objetivo principal de nuestra investigación es doble: primero, identificar el compromiso de los ciudadanos[1] andaluces con sus gobiernos locales a través de las redes sociales, y segundo, una vez identificada la forma en que interactúan los ciudadanos, explorar cómo los gobiernos locales andaluces utilizan las redes sociales para divulgar la información que sus ciudadanos les exigen.

El crecimiento explosivo de las comunicaciones de Internet y el gran volumen de datos digitales producidos por el público en todo el mundo han revolucionado la *open source intelligence* (OSINT)[2] (Williams & Blum, 2018), un término que se remonta a la Segunda Guerra Mundial cuando EE. UU. emprendió el diseño de esta disciplina de inteligencia[3] como instrumento de apoyo a las decisiones y acciones de su gobierno (Burke, 2007;

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[1] El compromiso ciudadano se identificará mediante las métricas de las redes sociales (me gusta, comentarios y compartir), que están diseñadas para permitir que la información se difunda rápidamente, sea de gran alcance y fomente la interacción entre los usuarios (O'Dea *et al.,* 2018).

[2] El término en inglés se traduce como "inteligencia de fuentes abiertas", y se define como "la disciplina que pertenece a la inteligencia producida a partir de información disponible públicamente que se recopila, explota y difunde de manera oportuna a un público apropiado con el fin de abordar un requisito de inteligencia específico" (National Defense Authorization Act for Fiscal Year 2006).

[3] Es un término de seguridad militar. "La inteligencia es información recopilada dentro o fuera de los EE. UU. que puede proporcionar información no disponible en otros lugares y que advierte sobre posibles amenazas y oportunidades". Existen seis fuentes básicas de inteligencia o disciplinas: HUMINT, SIGINT, IMINT, MASINT, GEOINT y OSINT (DNI, 2019).

Schaurer & Störger, 2013). OSINT difiere de la inteligencia tradicional, ya que recopila datos a través de recursos públicos accesibles, como redes sociales, medios, blogs y comunidades web (Pellet *et al.,* 2019).

Las redes sociales proporcionan una plataforma importante para difundir información de código abierto, incluido cualquier contenido web, intercambio de opiniones y debates (Giordano *et al.,* 2015), siendo esta una fuente de información que supera a una variedad de otras fuentes debido a su oportunidad y facilidad de acceso (Richelson, 2015), por lo que las herramientas de OSINT que permiten recopilar información de inteligencia de redes sociales se agrupan en la *social media intelligence* (SOCMINT)[4].

De esta forma, para abordar los objetivos de este estudio expuestos anteriormente, aplicaremos herramientas de OSINT en el campo de SOCMINT, con las cuales, al poder acceder sin ninguna limitación a la información publicada en las redes sociales, se obtendrá la totalidad de las publicaciones de cada municipio en unos pocos minutos de forma automática sin importar la cantidad, proporcionando así información creíble que contribuye positivamente al proceso de análisis de la información para obtener unas conclusiones respecto de un escenario muy próximo a la realidad. La recopilación y entrega continua de información confiable y precisa puede conducir a respuestas precisas y decisiones estratégicas correctas (Pellet *et al.,* 2019).

Antecedentes del problema

Gobiernos locales y redes sociales

La rápida adopción de las aplicaciones de redes sociales por parte del público está dando paso a nuevas formas para que los gobiernos se comuniquen y participen con los ciudadanos (Guillamón *et al.,* 2016). Al usar los gobiernos las redes sociales como canal de comunicación, adoptan un perfil más abierto y transparente que incentiva a los ciudadanos a estar más dispuestos a participar con sus comentarios en los asuntos públicos (Bonsón *et al.,* 2012; Mergel, 2013).

En el campo académico, los gobiernos locales con mayor población son, por regla

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[4] SOCMINT es un término en inglés recientemente acuñado para la confluencia de ideas de la inteligencia de código abierto (OSINT) y la técnica de minería web (aprendizaje automático y métodos de bases de datos) aplicadas a los datos de las redes sociales para identificar y comprender el comportamiento de las personas e identificar situaciones que afectarían a la seguridad nacional, para tratar de tomar decisiones racionales para llevar las situaciones al estado deseado (Șușnea & Iftene, 2018).

general, los seleccionados por los investigadores de la materia para estudiar sus experiencias en las redes sociales, ya que estos gobiernos tienden a desarrollar un mayor avance tecnológico (Mossberger *et al.,* 2013; Reddick & Norris, 2013). Sin embargo, para los pequeños gobiernos locales, las redes sociales, por sus características de plataformas abiertas de interacción, son útiles para mejorar su capacidad de informar e interactuar con sus ciudadanos y el público en general (Gao & Lee, 2017), por lo que es preciso considerar estudiar el comportamiento no solo de los gobiernos locales grandes, sino también de los pequeños.

OSINT y redes sociales

Las distintas técnicas de recopilación y análisis de OSINT son utilizadas por investigadores de diversas áreas, debido a su accesibilidad y capacidad de corroborar información (Shere, 2020b). Una de las principales fuentes de información OSINT de donde los investigadores pueden recopilar información públicamente disponible son las redes sociales (SOCMINT) (Edwards & Urquhart, 2016). SOCMINT es un componente cada vez más importante de la inteligencia digital, y una fuente importante de información (Omand, 2017). Además, entre las distintas disciplinas o fuentes básicas de inteligencia (HUMINT, SIGINT, IMINT, MASINT, GEOINT y OSINT), SOCMINT es la disciplina que ha permitido que sean cada vez más accesibles las herramientas de OSINT para los ciudadanos que simplemente quieren rastrear perfiles de redes sociales en busca de información[5] (Shere, 2020a).

Las redes sociales son fuente de numerosas oportunidades para los investigadores debido al gran volumen de datos útiles ubicados en un solo lugar (Giordano *et al.,* 2015; Hassan & Hijazi, 2018). Los datos disponibles en ellas no son solo simplemente el contenido original publicado por el usuario, como un contenido de texto, una imagen o un vídeo, sino que también se encuentran a disposición los metadatos asociados con el contenido original, como la fecha, la hora y la información de ubicación geográfica asociada con el contenido publicado (Pérez *et al.,* 2018).

A menudo, los usuarios desconocen cuánta información revelan cuando usan redes sociales, como Twitter, donde "un solo tweet de 140 caracteres puede contener 9 kB de metadatos sobre el usuario, incluido sus seguidores, sus antecedentes y su ubicación"

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[5] A pesar de la popularidad de SOCMINT, se trata de una disciplina acuñada en 2012 por D. Omand, J. Bartlett y C. Milleret que aún no es considerada una disciplina de inteligencia.

(Sinnott & Sun, 2016). Los resultados de varios experimentos han demostrado cómo las técnicas *big data* de análisis de redes sociales y minería de datos han podido ser utilizadas para inferir atributos de un usuario basándose en la información revelada por otro usuario (Gil, 2016). Pérez, Musolesi y Stringhini (2018) demostraron que, teniendo en cuenta los metadatos de 5 millones de usuarios de Twitter, es posible identificar a 10 usuarios en un grupo de 10.000 con una precisión de 99,22%. A pesar de ello, los usuarios siguen compartiendo contenido en sus redes sociales, mientras que una de sus principales preocupaciones en Internet es la privacidad (Fundación Telefónica, 2019), lo que da base al fundamento de la "paradoja de la privacidad"[6] en las redes sociales.

No obstante, la explotación de la información de las redes sociales se considera cada vez más relevante y rentable, lo que plantea nuevas preocupaciones éticas (Rønn & Søe, 2019), como la que ha surgido tras la revelación de que Facebook entregara información de identificación personal de más de 87 millones de usuarios a Cambridge Analytica[7], lo que ha supuesto que sea de imperativo desarrollar leyes integrales de política de privacidad (Isaak & Hanna, 2018).

Tras este escándalo, las corporaciones al frente de las redes sociales han adoptado un perfil cada vez más restringido y regulado con el acceso a sus API[8] (Perriam *et al.,* 2020). Esto deja a los investigadores académicos en una situación complicada para realizar estudios con datos de redes sociales, por lo que se reducen las investigaciones que utilizan las API (Acker & Kreisberg, 2020).

A la hora de abordar investigaciones sobre redes sociales, los académicos pueden extraer

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[6] La paradoja de la privacidad es la discrepancia entre las intenciones de los usuarios de proteger su privacidad y su comportamiento real (Barnes, 2006). Actualmente hay un debate abierto en la comunidad científica acerca de la existencia de dicha paradoja. Mientras que algunos autores (Xie *et al.,* 2019) sí muestran que se cumple, otros indican que no, ya que "demuestra que los usuarios se comportan como actores racionales capaces de identificar amenazas a su privacidad y ajustar los contenidos que publican en redes sociales, y también con quién los comparten, en consecuencia" (Gruzd & Hernández-García, 2018); además, sugieren que "si las diferentes plataformas no son capaces de abordar esta preocupación, los usuarios pueden pasar a publicar menor cantidad de contenido y menos detallado, lo que reduciría el valor de los datos".

[7] La empresa de análisis de datos que trabajó con el equipo electoral de Donald Trump y la campaña ganadora del Brexit recopiló millones de perfiles de votantes estadounidenses en Facebook, en una de las violaciones de datos más grandes de la historia del gigante tecnológico, y los utilizó para crear un poderoso programa de software para predecir e influir en las decisiones en las urnas (Cadwalladr & Graham-Harrison, 2018).

[8] *Application programming interface* (API) es la interfaz de programación de aplicaciones. Una API es una interfaz de fondo a través de la cual los desarrolladores externos pueden conectar nuevos complementos a un servicio existente, y además también es una interfaz para que los investigadores recopilen datos de un determinado servicio de redes sociales para el análisis empírico (Lomborg & Bechmann, 2014).

los datos de forma manual o automática, aunque, como la tecnología está avanzando a pasos agigantados, no tiene sentido realizar extracciones de los datos de forma manual al haber disponibles tantas herramientas automáticas (Cukier & Mayer-Schoenberger, 2013). Una de las opciones de extracción automática más extendida es el uso de las API, a pesar de sus restricciones. Y es que resulta que, por ejemplo, se ha sugerido en numerosos estudios anteriores que el número de 200 tweets por usuario es suficiente para extraer sus características (Albalawi *et al.,* 2019; A. Kim *et al.,* 2017; Sap *et al.,* 2014; Volkova *et al.,* 2015; Volkova & Van Durme, 2015), sin embargo, el no extraer la mayoría de los datos puede dar lugar a un sesgo de muestreo, pero para evitarlo se puede adoptar la tecnología *big data.* En ella se permite realizar un muestreo que considera la totalidad de la población, surgiendo el concepto de N = Todo (Mayer-Schönberger & Cukier, 2013). Hay que tener presente que Perrons y McAuley (2015) plantean que recopilar y analizar todos los datos potencialmente relacionados con un caso supone hacer frente a unas realidades económicas y técnicas requeridas que, en el caso de las redes sociales, generalmente, suponen costos relativamente bajos, ya que gran parte de su información se ofrece voluntariamente, pero en algunos campos (como la minería), la adquisición y el almacenamiento de todos los datos genera unos costes marginales bastantes altos, por lo que se adopta un distinto enfoque de *big data* con estrategias de recopilación de datos N < Todo. De todas formas, "N = Todo es a menudo una suposición más que un hecho sobre los datos" (K. Fung, 2013), es decir, que, en definitiva, al hacer uso del *big data,* se investiga con conjuntos de datos y técnicas analíticas en aplicaciones que son tan grandes y complejas que requieren tecnologías avanzadas de almacenamiento, gestión, análisis y visualización de datos (Chen *et al.,* 2012) e implican renunciar a datos limpios cuidadosamente seleccionados y tolerar algo de desorden (Cukier & Mayer-Schoenberger, 2013).

Para la búsqueda de fuentes de información y para captar la totalidad de los datos que permita realizar análisis de *big data,* se emplea la metodología OSINT (Williams & Blum, 2018). Existe esta posibilidad de obtener grandes volúmenes de datos mediante herramientas y técnicas de OSINT, ya que tiene la ventaja de poder acceder sin apenas limitaciones a toda la información que está disponible públicamente, por lo que deben ser accesibles legalmente por el público sin violar ningún derecho de autor, patentes o leyes de privacidad (DFM Team, 2019).

Es importante que los investigadores que recopilamos datos mediante OSINT tengamos

presentes unas leyes de protección de datos para cumplir con las bases éticas y legales sobre la forma en que se recopilan, procesan y conservan la información personal de los ciudadanos. Esta base legal se estipula en el General Data Protection Regulation (GDPR)[9] con unas competencias a nivel de la Unión Europea. Sin embargo, Shere (2020b) sostiene que el GDPR es simplemente un primer paso para establecer expectativas y regulaciones sociales en torno a la privacidad digital, dado que, según su encuesta, en la práctica pocos cambios sustanciales se han producido en los métodos o análisis de OSINT por la entrada en vigor del GDPR. Por tanto, las investigaciones aplicando OSINT no se ven afectadas por el GDPR, ya que, en definitiva, desde un punto de vista formal, el uso de la regulación europea como un instrumento legal de unificación y uniformidad de la legalidad respecto del régimen de datos personales en la UE es más teórico que real (Martínez-Martínez, 2018).

En el presente estudio se ha tenido en consideración toda la base ética y legal en la extracción, almacenamiento y tratamiento de los datos. No se contempla ninguna información personal al no tratar ningún dato de los que se consideran personales, como se define en el artículo 4 del GDRP (Regulation (EU) 2016/679, 2016):

"Datos personales: toda información sobre una persona física identificada o identificable (el interesado); se considerará persona física identificable toda persona cuya identidad pueda determinarse, directa o indirectamente, en particular mediante un identificador, como, por ejemplo, un nombre, un número de identificación, datos de localización, un identificador en línea o uno o varios elementos propios de la identidad física, fisiológica, genética, psíquica, económica, cultural o social de dicha persona".

No se analiza ningún perfil de una persona física, sino que las cuentas de las redes sociales de Twitter e Instagram analizadas son las de los gobiernos locales andaluces, que, por su naturaleza, no son consideradas privadas, ya que, según una sentencia del Tribunal Superior de Justicia de Castilla-La Mancha (STSJ CLM 946/2018), las redes sociales de

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[9] El GDPR es el reglamento europeo relativo a la protección de las personas físicas en lo que respecta al tratamiento de sus datos personales y a la libre circulación de estos datos. Entró en vigor el 25 de mayo de 2016 y fue de aplicación el 25 de mayo de 2018, dos años durante los cuales las empresas, las organizaciones, los organismos y las instituciones se fueron adaptando para su cumplimiento. Disponible en https://www.boe.es/doue/2016/119/L00001-00088.pdf
En España, el GDPR dejó obsoleta la Ley Orgánica de Protección de Datos de Carácter Personal (LOPD) de 1999, siendo sustituida el 6 de diciembre de 2018 por la Ley Orgánica de Protección de Datos Personales y Garantía de los Derechos Digitales (LOPD-GDD), acorde con el GDPR. Disponible en https://www.boe.es/buscar/doc.php?id=BOE-A-2018-16673

las administraciones públicas se encuentran financiadas por recursos públicos, por lo que pertenecen a los ciudadanos y deben servir a estos.

Se cumple lo establecido en las políticas de privacidad de las dos redes sociales analizadas. Twitter deja claro que "Twitter es público y cualquier persona en todo el mundo puede ver y buscar los tuits inmediatamente" (Twitter, 2020). Mientras que Instagram facilita investigaciones a académicos "que permitan profundizar en los conocimientos y la innovación necesarios para promover el descubrimiento y la innovación" (Instagram, 2020).

Además, los expertos de OSINT generalmente consideran que la información compartida en sitios de redes sociales pertenece al dominio OSINT porque es información pública compartida en plataformas públicas en línea y, por lo tanto, puede explotarse con fines de inteligencia (Hassan & Hijazi, 2018).

Planteamiento del problema y pregunta de investigación

Un considerable interés de los investigadores sobre las redes sociales (Bonsón *et al.,* 2012; Wilson *et al.,* 2012) se traduce en una extensa producción académica sobre ellas, siendo la mayoría de los estudios de naturaleza teórica/conceptual, tanto en el análisis del sector privado (Bhimani *et al.,* 2019) como en el del sector público (Dwivedi *et al.,* 2017). En cambio, nuestra investigación presenta una naturaleza de análisis tanto cuantitativo como cualitativo para complementar los escasos estudios que recopilan ambos tipos de información (Tseng, 2017).

En cuanto al sector público, las investigaciones se centran en el uso de herramientas de redes sociales por parte de los políticos a nivel estatal, existiendo un número mucho menor de estudios que analicen a nivel local su uso por parte de los líderes, como los alcaldes, y por parte de las instituciones, como los ayuntamientos (Sobaci & Karkin, 2013). Además, estos estudios previos se centran más en el análisis de las redes sociales como herramienta para campañas electorales (Jungherr, 2016), y en menor medida como plataformas para la participación ciudadana. Por tanto, para ir más allá de la percepción del uso de las redes sociales como una herramienta solo con fines políticos y a un nivel estatal, nuestra investigación analiza el uso de las redes sociales como plataformas de participación ciudadana por parte de los municipios.

Con respecto a las investigaciones sobre las plataformas de redes sociales, existen un

amplio número de estudios de divulgación de Facebook y Twitter; en cambio, hay un número limitado sobre Instagram (Blank & Lutz, 2017). A pesar de los numerosos artículos sobre Twitter, esta investigación analiza esta plataforma junto a Instagram, ya que ambas abarcan una red más amplia de contactos potenciales que otras redes sociales como Facebook debido a que ambas plataformas (en mayor grado Twitter y, a continuación, Instagram) presentan un alto capital social puente[10] (Phua *et al.,* 2017). Tanto en Instagram como en Twitter existe seguimiento no recíproco, los usuarios pueden seguir a otras personas con las que no tienen una relación, como organizaciones (Jin & Phua, 2014), sin la necesidad de aprobación o reciprocidad (Waterloo *et al.,* 2018).

Por último, nuestro estudio ofrece una nueva vía de investigación al contar con la totalidad de las publicaciones de las cuentas a analizar, y es que resulta que los trabajos previos no obtienen el 100% de las publicaciones de las redes sociales, ya que los recolectan de forma manual (Bonsón *et al.,* 2016, 2017; I. C. H. Fung *et al.,* 2017) o de forma automática a través de las API (Hu *et al.,* 2014; Romero *et al.,* 2011; Van Dam & Van De Velden, 2015).

Cada red social tiene una API que permite obtener información, pero con limitaciones y con versiones *premium* (de pago). Twitter solo puede devolver hasta 3200 de los tuits más recientes de un usuario (Twitter Developers, 2019), mientras que la API de Instagram es más restrictiva o incluso inexistente (Murthy *et al.,* 2016), ya que solo permite acceder a los comentarios y *posts* de la cuenta del propio usuario, sin la posibilidad (en la versión básica) de obtener una lista de *posts* de otros usuarios ni obtener una lista de publicaciones con un determinado *hashtag* (Facebook for developers, 2019). Estas limitaciones suponen una extracción insuficiente cuando, por ejemplo, las cuentas de Twitter de los gobiernos locales tienen de promedio 14.531 tuits (Bonsón *et al.,* 2019), es decir, que con la API oficial de Twitter solo se obtendría un 22% de los tuits. (Pfeffer *et al.,* 2018). Por lo tanto, para obtener la totalidad de las publicaciones, este estudio adopta nuevas formas de extracción de datos con herramientas de OSINT en el campo de SOCMINT. Estas herramientas, Twint (Zacharias & Poldi, 2018) para Twitter e Instaloader (Graf, 2017) para Instagram, se aplican mediante el *software* de código abierto Python (Van Rossum, 1995). Ambas herramientas avanzadas de raspado se recogen en el kit de herramientas[11]

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[10] El capital social puente se refiere a las relaciones débiles y distantes entre las personas, ofreciendo oportunidades para compartir información, mientras que el capital social vinculo se aplica a las relaciones sólidas que brindan parentesco emocional, confianza y apoyo social (Putnam, 2000).
[11] Disponible en la página web bit.ly/bcattools

de investigación de código abierto del respetado e innovador grupo de inteligencia de código abierto Bellingcat[12].

En resumen, esta investigación aborda un análisis cuantitativo y cualitativo centrado en Twitter e Instagram como plataformas ciudadanas para los municipios, contando con la recolección de información de la totalidad de sus publicaciones gracias a herramientas OSINT.

Para completar los vacíos señalados anteriormente en la literatura académica, planteamos nuestra pregunta de investigación principal (RQ): ¿Cómo los ciudadanos andaluces utilizan Twitter e Instagram para interactuar con sus gobiernos locales y cómo estos satisfacen la necesidad informativa que demandan los ciudadanos? A nuestro entender, ningún estudio ha examinado esta cuestión teniendo en cuenta la totalidad de las publicaciones. Además, cada uno de los tres capítulos previstos en esta disertación presenta preguntas de investigación adicionales para completar la principal.

Marco teórico

La investigación sobre las redes sociales se ha convertido en un tema de gran éxito en los últimos años que se ha traducido en una multitud de áreas que producen estudios para comprender el uso de las redes sociales en los que toman parte múltiples disciplinas, algunas más populares que otras, como la ciencia de datos, las ciencias sociales, la ciencia de la conducta o la ciencia de los sistemas de información (Qi *et al.,* 2018).

Además, las investigaciones sobre las redes sociales pueden ofrecer nuevas contribuciones en diversas áreas como la sociología, la economía o la comunicación, entre otras (Ratkai, 2014), debido a que gran parte de la investigación empírica para estudiar las redes sociales ha utilizado teorías de diversos campos, como teorías de la comunicación (teoría dialógica), teorías económicas (teoría de la agencia) o teorías sociopolíticas (teoría de los *stakeholders* y teoría de la legitimidad).

Por lo tanto, para el fin de nuestra investigación hemos decidido respaldar nuestra

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[12] Bellingcat se definen ellos mismos como "un colectivo internacional independiente de investigadores y periodistas ciudadanos que utiliza la investigación de fuentes abiertas y redes sociales para investigar una variedad de temas". Entre esos temas destaca, y por el cual alcanzaron su notoriedad, el rastreo en las redes sociales del curso de la invasión rusa encubierta en Ucrania en 2014, incluida la tragedia del vuelo de pasajeros MH17 de Malaysia Airlines derribado por el ejército ruso (Patrikarakos, 2017; Pendry, 2017) o temas tan actuales como la utilización de un sistema para categorizar desinformación del COVID-19 (Etim *et al.,* 2020).

pregunta de investigación mediante la aplicación de estas teorías. El enfoque de combinar estas teorías ya se ha implantado en estudios anteriores (Bednárová, 2014; Ratkai, 2014), ya que no se consideran excluyentes entre sí, sino que se trata de teorías complementarias. Cada una de ellas va a ser explicada y detallada en la fundamentación teórica de los capítulos de esta investigación.

Diseño del estudio

Esta tesis está compuesta por tres artículos de investigación que se corresponden con sus tres capítulos. A pesar de que cada artículo se puede considerar como una unidad de investigación independiente, son coherentes entre ellos, conformando así una unidad de investigación conjunta.

Figura 1: Desarrollo argumental de la tesis
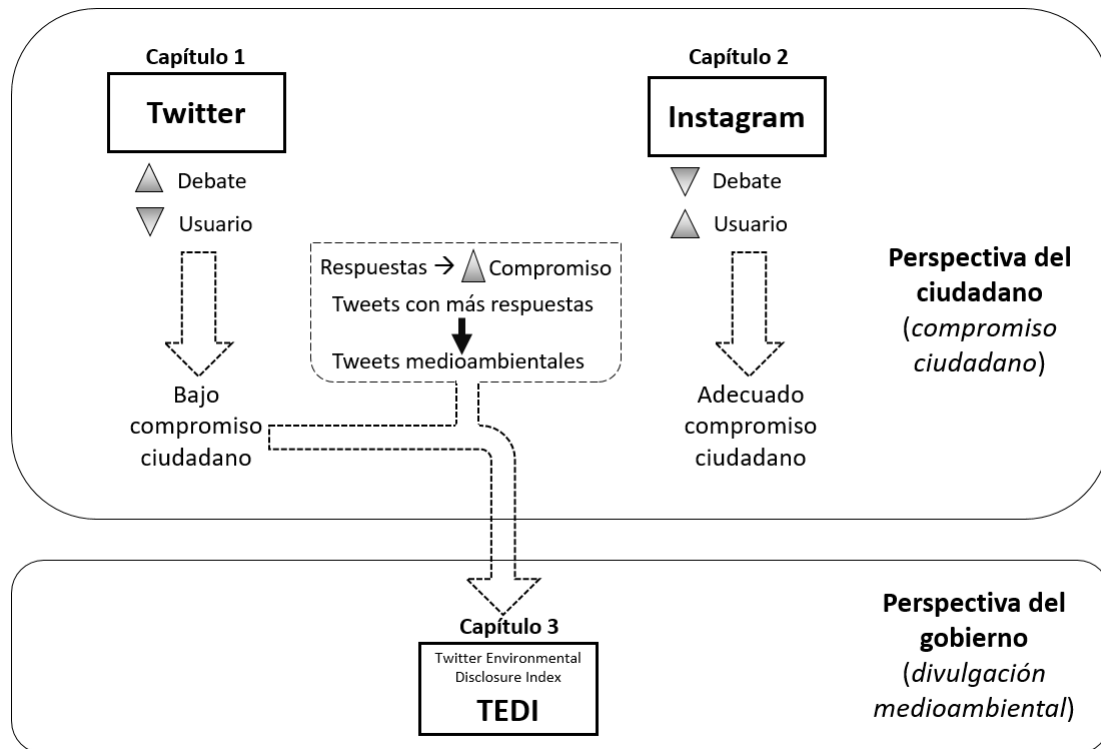
La composición de la tesis se presenta en la Figura 1. La investigación se realiza enfocándose, inicialmente, en los ciudadanos (perspectiva del ciudadano) y, posteriormente, en los gobiernos locales (perspectiva del gobierno). Los dos primeros capítulos, bajo la perspectiva del ciudadano, están dedicados a Twitter (capítulo 1) y a Instagram (capítulo 2) como plataformas de compromiso ciudadano con los gobiernos locales. Una vez analizado e identificado lo que presenta mayor interés para los ciudadanos en ambas redes sociales, se presenta el último apartado (capítulo 3) bajo la

perspectiva del gobierno, dedicado a Twitter como un canal de divulgación medioambiental por parte los gobiernos locales.

Esta investigación se inicia analizando individualmente dos plataformas muy diferentes con características y público distintos. Twitter presenta características más propias para facilitar el debate que Instagram, y es la más usada por parte de los políticos (Marcos, 2018). En cambio, Instagram presenta un número de usuarios mayor que Twitter (We are social & Hootsuite, 2020). En definitiva, Twitter se relaciona con motivaciones informativas y educativas e Instagram con presentar un yo más popular y por motivos de entretenimiento (Kircaburun *et al.,* 2020).

Para ambos casos fueron recolectadas y analizadas la totalidad de las publicaciones tanto de Twitter como de Instagram de cada uno de los 29 municipios andaluces más poblados (> 50.000 habitantes), que juntos representan más de la mitad de la población andaluza (IECA, 2017).

Se desarrollan ambos escenarios para analizar el compromiso ciudadano con los gobiernos andaluces en cada red social, de los cuales se obtuvieron numerosos hallazgos interesantes que se detallan en el primer subapartado (hallazgos empíricos) del siguiente apartado (diseño del estudio). Sin embargo, destacamos el reducido nivel de compromiso ciudadano en Twitter en comparación con Instagram (0.57 puntos frente a 21.25 puntos). Por lo tanto, dando por adecuado el compromiso que se genera en Instagram, nos centramos en Twitter para ver si los gobiernos locales divulgan mediante los tuits lo que les exigen sus ciudadanos a través de las respuestas, ya que las respuestas generan mayor compromiso de los usuarios porque, en comparación con los retuits y los "me gusta" que están a golpe de un clic, estos implican más trabajo al escribir el mensaje (J. Kim & Yoo, 2012). Además, a diferencia de los retuits y los "me gusta"*,* que normalmente son una indicación de aprobación, las respuestas a los tuits pueden ser un comentario positivo o negativo hacia el tema de discusión (Calais Guerra *et al.,* 2011). Por todo ello, analizaremos los tuits que generan más comentarios, que son los tuits de contenido medioambiental.

Finalmente, se ofrece una visión real de cómo los gobiernos locales andaluces utilizan Twitter para divulgar sobre asuntos medioambientales y se identifican los factores determinantes de dicha divulgación. Se amplía la muestra a los 153 municipios andaluces con mayor población (> 10.000 habitantes), donde reside casi el 80% de la población

andaluza (IECA, 2017). Para la medición, diseñamos un índice de divulgación medioambiental en Twitter, el TEDI *(Twitter environmental disclosure index).*

Para la recolección de las publicaciones de ambas redes sociales se han aplicado herramientas de OSINT en materia de SOCMINT, permitiendo obtener la totalidad de las publicaciones. Las publicaciones se analizan a partir de dos capas: el contenido original publicado y los metadatos asociados a ellas (Kujawski, 2019). Como este es, a nuestro entender, el primer estudio que proporciona una visión muy cercana a la realidad del uso de las redes sociales por parte de los gobiernos locales, los académicos y los profesionales pueden beneficiarse de esta investigación.

Discusión de resultados

Los tres artículos que componen esta tesis han sido publicados (o aceptados para la publicación) en revistas académicas internacionales de impacto como *Government Information Quarterly* ("Twitter as a tool for citizen engagement: An empirical study of the Andalusian municipalities", 2019), *Instagram Communication* ("Citizen reactions to municipalities", 2020) e *International Journal of Public Administration in the Digital Age* ("Environmental disclosure as a tool for public sector legitimacy: A Twitter intelligence approach", 2020).

Cada artículo corresponde a un capítulo de la tesis con el objetivo de evidenciar y apoyar a la pregunta principal de la investigación: (RQ): ¿Cómo los ciudadanos andaluces utilizan Twitter e Instagram para interactuar con sus gobiernos locales y cómo estos satisfacen la necesidad informativa que demandan los ciudadanos? Además, como cada capítulo se puede tratar como una unidad independiente de investigación, cada uno de ellos contiene sus propias preguntas.

El primer capítulo pretende dar respuestas a las siguientes preguntas de investigación: (1) ¿El tamaño de un municipio influye en su compromiso ciudadano en Twitter?; (2) ¿La actividad en Twitter influye en el compromiso ciudadano?; (3) ¿La audiencia influye en el compromiso ciudadano?; (4) ¿El tipo de medio influye en el compromiso ciudadano?; (5) ¿El tipo de contenido influye en la participación ciudadana?

El segundo capítulo trata sobre las siguientes preguntas de investigación: (1) ¿En qué medida los municipios utilizan Instagram como canal de comunicación para interactuar con sus ciudadanos y qué motiva su uso?; (2) ¿Qué variables afectan la actividad de

Instagram de los municipios?; (3) ¿Qué variables afectan las reacciones ciudadanas en Instagram?

El tercer y último capítulo tiene como objetivo responder las siguientes preguntas de investigación: (1) ¿Cómo utilizan Twitter los gobiernos locales para divulgar cuestiones medioambientales?; (2) ¿Cuáles son los factores que influyen en la divulgación medioambiental de los gobiernos locales en Twitter?

Hallazgos empíricos

Los hallazgos empíricos obtenidos del estudio son específicos de cada capítulo, por lo que están detallados en cada uno de ellos. En esta sección se sintetizan los descubrimientos más relevantes para poder responder a la pregunta de investigación planteada.

En busca de una respuesta de cómo las redes sociales Twitter e Instagram son plataformas útiles para que los gobiernos locales puedan cargar publicaciones sobre asuntos de interés y para que sus ciudadanos puedan informarse e interactuar con ellos, los resultados muestran que hay diferencias claramente sustanciales entre las cuentas de Twitter e Instagram de los municipios en cuanto al número de publicaciones (actividad) y al número de seguidores (audiencia). El número de población de cada municipio no es un factor a considerar debido a que existe una ausencia de patrones o relaciones entre la población del municipio y los niveles de compromiso ciudadano en ambas plataformas.

Nuestros resultados muestran que los gobiernos locales prefieren Twitter para albergar sus cuentas corporativas municipales en comparación con Instagram, a pesar de que es en Twitter donde menos compromiso ciudadano (0.57) consiguen frente a Instagram (21.25). Aunque ambas redes sociales comparten similitudes, los ciudadanos se relacionan en ellas con los gobiernos locales de diferente forma. Esta comparación queda recogida en la siguiente tabla resumen de los hallazgos (Tabla 1).

Hallazgos	Twitter	Instagram
Gobiernos locales	96.55%	58.62%
Compromiso	0.57	21.25
Contenido + publicado	Cultura y promoción de la ciudad	
Medio + publicado	Enlace web	Foto
Compromiso-Actividad	Relación negativa	
Compromiso-Población	No confirmado	
Compromiso-Audiencia	Relación negativa	No confirmado
Métrica + Compromiso	Retweets	Me gusta
Medio + Compromiso	Foto/Video (*Retweet y favoritos*) Texto (*Respuestas*)	Foto (*Me gusta*) Video (*Comentarios*)
Contenido + Compromiso	Deporte (*Retweet y Favoritos*) Medioambiente (*Respuestas*)	Cultura y promoción de la ciudad y otros contenidos (*Me gusta*) Transporte y obras públicas (*Comentarios*)

Tabla 1. Resultados comparativos de Twitter (capítulo 1) vs. Instagram (capítulo 2)

Es preciso mencionar que en ambas redes sociales se muestra una relación negativa entre la actividad y el compromiso ciudadano que se debe a que los algoritmos de las redes sociales perjudican la visibilidad de las publicaciones de las cuentas con poco compromiso. Además, se halló que el tipo de contenido y medio utilizado tiene un impacto en el compromiso de los ciudadanos. Sin embargo, los resultados muestran que la demanda de los ciudadanos y la oferta de los gobiernos locales en este sentido sobre los medios (foto, video, etc.) utilizados en una publicación por el municipio y el contenido (de qué trata la publicación) presentan controversia. En especial en Twitter, donde los tuits con fotos o vídeos son los medios preferidos por los ciudadanos, mientras que los

gobiernos locales se inclinan más por publicar tuits con enlaces a páginas web.

Respecto a la adopción de las redes sociales por parte de los gobiernos locales, se obtuvo que son los municipios con menor deuda pública los que adoptan y usan más activamente Instagram.

En relación con la deuda pública, según nuestros resultados del capítulo 3, son los municipios con más superávit presupuestario, además de los municipios con mayor número de redes de compromiso sostenible, los que más tienden a informar sobre temas ambientales a través de Twitter.

El capítulo 3 ofrece una visión sobre cómo Twitter está siendo utilizado por los gobiernos locales para la divulgación sobre asuntos de medioambiente. Según nuestros resultados, el uso de Twitter como herramienta de divulgación medioambiental (TEDI[13]) es casi inexistente, a pesar de su potencial al ser demandado por los ciudadanos.

Los niveles de compromiso tanto en Twitter como en Instagram como el TEDI obtenidos como resultados de los capítulos de esta tesis se representan en los mapas de Andalucía de la Figura 2. Donde se muestra en una escala logarítmica el bajo nivel de los tres indicadores, habiendo así mayormente municipios coloreados en tonalidades de niveles bajos.

Figura 2: Compromiso de Twitter e Instagram y el TEDI en Andalucía

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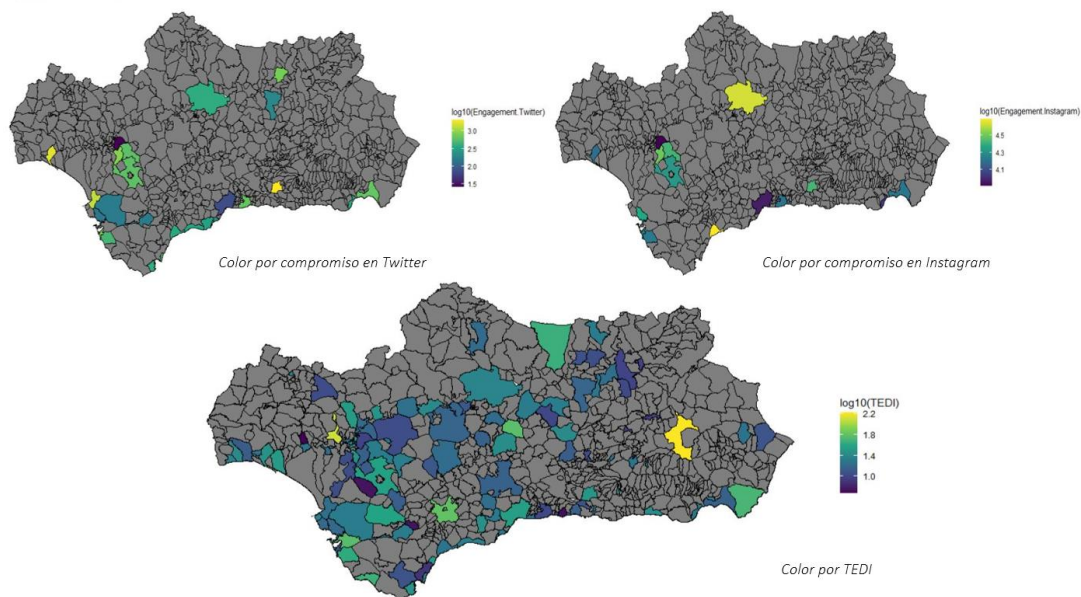
[13] TEDI *(Twitter environmental disclosure index)* es un índice de divulgación ambiental en Twitter elaborado por los autores de esta investigación.

Aportes (implicaciones)

La aportación de esta tesis es proporcionar una visión general conceptual mediante el compromiso ciudadano de cómo los gobiernos locales andaluces utilizan los canales Twitter e Instagram. De esta forma, los hallazgos de esta investigación podrían contribuir significativamente a la literatura de las redes sociales en la administración pública, en especial en el campo del compromiso.

Probablemente, estos hallazgos pueden suponer la base para construir un modelo de compromiso de Twitter e Instagram para que los municipios expliquen la relación entre los factores antecedentes, el compromiso que se produce y los efectos actitudinales y de comportamiento de los usuarios.

También cabe resaltar que en el capítulo 2 se ha recogido una tabla comparativa de las características y funciones entre Facebook, Twitter e Instagram según la literatura previa (Tabla 1) que contribuya de forma significativa a la escueta literatura sobre la red social Instagram.

Una de las contribuciones más importantes a nivel teórico y práctico es la elaboración en todos los capítulos de diccionarios de palabras claves para clasificar las publicaciones según su contenido de forma automática. En especial, en el capítulo 3, la creación de un diccionario de palabras claves ambientales basado en los estándares de las memorias de sostenibilidad del Global Reporting Initiative (GRI 300), que nos permitió desarrollar un índice de divulgación ambiental de Twitter (TEDI) que mide la difusión ambiental en la red social Twitter.

Otro aporte importante para los académicos es presentar la existencia a la comunidad científica de la poderosa metodología que hemos aplicado, que nos permite realizar análisis automáticos y masivos, desde aplicar herramientas OSINT con Twint e Instaloader para extraer todas las publicaciones de Twitter e Instagram respectivamente hasta cómo tratarlas posteriormente con el *software* de código abierto Python. Todo este proceso metodológico está explicado debidamente en los tres capítulos de esta tesis, e ilustrado para facilitar su compresión en las figuras de los mismos (Figura 1, capítulo 1; Figuras 1 y 2, capítulo 2; Figura 1, capítulo 3).

De esta forma se alienta a los académicos de este campo a realizar investigaciones siguiendo esta metodología. Así proliferarán trabajos con hallazgos más cercanos a la

realidad al poder extraer masivamente información a estudiar. Contar con más casos de trabajos empíricos a nivel de gobiernos municipales que se elaboren con la totalidad de los datos y permitan nuevas evaluaciones de las dimensiones locales facilitará la generación de estrategias alcanzables. Por ello, creemos que los hallazgos les pueden ser útiles a los *community managers* de los ayuntamientos al tener en cuenta los factores que influyen en el compromiso de los ciudadanos para diseñar estrategias de comunicación en línea fructíferas.

Limitaciones y recomendaciones futuras

En la presente investigación se ha implementado una innovadora y poderosa metodología, lo que no ha impedido que, como consecuencia directa de nuestro análisis, se encuentren en el estudio un cierto número de limitaciones. Cabe mencionar que aquí solo se incluirán aquellas limitaciones relevantes y/o generales junto con el futuro esquema de investigación más interesante para evitar repetir contenido, ya que al final de cada capítulo se incluyen las limitaciones inherentes al mismo y las investigaciones futuras propuestas.

En los dos primeros capítulos se analizan solo 29 municipios, lo que supone un sesgo de muestreo a la hora de generalizar los resultados, aunque es necesario precisar que esa muestra recoge los municipios andaluces con más de 50.000 habitantes, que representan el 50% de la población andaluza. Sin embargo, este sesgo se soluciona en el tercer capítulo, al tener en cuenta los municipios andaluces con más de 10.000 habitantes (153 municipios), lo que supone el 80% de la población de Andalucía.

Una limitación que sí está presente en todo el estudio es la relacionada con el análisis del contenido. En los tres capítulos se lleva a cabo una investigación que conlleva una clasificación de las publicaciones según su contenido que se aplica mediante diccionarios de palabras claves y que, al hacerse de forma automática, genera un cierto nivel de error al clasificar publicaciones en categorías que no les pertenecen.

Una vez identificadas las limitaciones del estudio, se plantean las investigaciones futuras más interesantes para alcanzar el objetivo de realizar una investigación bien diseñada que permita extraer algunas generalizaciones de los hallazgos en la población. Por tanto, una línea interesante a investigar sería mejorar la clasificación del contenido de las publicaciones haciéndolas más precisas mediante la aplicación de un diccionario de n-gramas. Otra vía de investigación para ampliar este estudio podría examinar los *hashtags*

para analizar su efecto en el compromiso ciudadano. Adicionalmente, para mejorar la comprensión y generalizar los hallazgos que permitan llevar a cabo estrategias alcanzables, los estudios futuros podrían dedicarse a realizar investigaciones en un contexto comparativo con otras regiones nacionales e internacionales.

Conclusiones

Las redes sociales no son solo unas plataformas para el público en general o para las empresas, sino que también las administraciones públicas adoptan las redes sociales como canal de comunicación y transparencia, en especial los gobiernos locales, que son los organismos con más incidencia en la vida cotidiana de la población. El mundo actual se encuentra inmenso en la revolución industrial 4.0, con la digitalización de los procesos productivos, pero esta transformación hacia la digitalización no es exclusiva de la industria, sino que las investigaciones académicas también aprovechan estos avances. Por tanto, los académicos de finales de la segunda década del siglo XXI debemos ser consecuentes con los tiempos que vivimos, no podemos plantear investigaciones sin tener presente metodologías de *big data* como las herramientas y técnicas OSINT. Estos nuevos avances tecnológicos han llevado a la apertura de nuevas vías de investigación.

Este estudio presenta dos logros principales (los dos objetivos principales planteados en el apartado de introducción): en primer lugar, se identifica a través de las redes sociales el compromiso de los ciudadanos andaluces con sus gobiernos locales; y, en segundo lugar, una vez identificada la forma en que interactúan los ciudadanos, se explora cómo los gobiernos locales andaluces utilizan las redes sociales para divulgar la información que sus ciudadanos les exigen. Hasta donde sabemos, este es el primer estudio que explora la comunicación municipal y la participación ciudadana a través de las plataformas de Twitter e Instagram mediante el análisis de la totalidad de sus publicaciones.

Se encontró que, a pesar de que ambas redes sociales tienen unos índices de penetración altos, desafortunadamente el compromiso ciudadano se mostró bajo. Tener un perfil corporativo en una red social con muchos usuarios no significa que se vaya a conseguir una audiencia comprometida, y es que, en general, se muestran indicios de que el interés por parte de la ciudadanía para informarse e interactuar con los gobiernos locales es escaso.

Es esta una realidad que los responsables de comunicación en redes sociales o *community managers* de los gobiernos locales parecen no ser conscientes de ella, debido a que

publican sin seguir estrategias efectivas que incentiven el compromiso en sus publicaciones. Aunque ha quedado comprobado tras estas investigaciones que en Twitter el contenido de los tuits que a los ciudadanos les genera más compromiso de respuestas es el medioambiental, en cambio los gobiernos locales hacen caso omiso de ello y apenas tuitean sobre este tema.

Es por todo ello que los *community managers* deben conocer los hallazgos presentados en esta tesis para poder diseñar estrategias efectivas para alentar el compromiso ciudadano. Por ejemplo, se detectó que algunos tipos de medios en las publicaciones provocan más compromiso de los ciudadanos: así pues, en Instagram, para generar que una publicación sea más viral, debe ir a acompañada de una foto, mientras que, para generar más debate en una publicación, esta debe ser un vídeo.

En definitiva, este estudio aporta algunas evidencias de que los gobiernos locales no sacan el máximo provecho a la potencialidad de las redes sociales. Aunque actúan en algunos aspectos con acierto, se caracterizan más por utilizar las redes sociales como un canal de comunicación unidireccional en vez de bidireccional, publicando información como una extensión más de comunicación tradicional y dirigiendo la información a páginas web o como mero escaparate de su municipio, adoptando un comportamiento de postureo[14].

Retomando la pregunta planteada al comienzo de este estudio (RQ): ¿Cómo los ciudadanos andaluces utilizan Twitter e Instagram para interactuar con sus gobiernos locales y cómo estos satisfacen la necesidad informativa que demandan los ciudadanos?, ahora es posible afirmar que los gobiernos locales andaluces aún tienen que aprender para ser más efectivos en las redes sociales. El uso inteligente de plataformas como Twitter o Instagram puede ser de gran utilidad para los gobiernos locales debido a su potencialidad.

Estas cuestiones han de ser tratadas por los gobiernos locales, así que ahora depende de ellos dedicar esfuerzos para derivar de este estudio algunas buenas prácticas y ponerlas en funcionamiento con el fin de lograr una comunidad más activa al mejorar los niveles de compromiso ciudadano y, por ende, un gobierno más transparente y comprometido. Todo esto supondría una estrategia *win-to-win* de la que tanto los gobiernos locales como los ciudadanos saldrían beneficiados.

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[14] El término *postureo,* definido por la Real Academia Española (RAE): "m. coloq. Esp. Actitud artificiosa e impostada que se adopta por conveniencia o presunción".

INTRODUCTION
AND PROBLEM STATEMENT

Introduction

Social media as a means of communication are being increasingly used in all areas, the constant penetration of social media being evident, since it turns out that many methods for sharing information have been subsumed by giant social media platforms that have a speed and reach incredible (Merchant & Lurie, 2020). The penetration of social media is 49% of the world population (We are social & Hootsuite, 2020). Therefore, practically half of the global population (3,800 million people) uses one or more social media network to upload and share publications about daily activities, and at the same time to inform and interact (Șușnea & Iftene, 2018).

Public administrators are no strangers to this scenario. Social media offer governments a new approach to good governance in the public sector, by increasing public transparency and accountability (Bonsón et al., 2012), and by creating a two-way communication channel between them and their citizens (Mergel, 2013).

Based on the above premises, the main objective of our research is twofold: first, to identify the engagement[15] of Andalusian citizens with their local governments through social media; and second, once the way in which citizens interact has been identified, to explore how Andalusian local governments use social media to disseminate information that their citizens demand of them.

The explosive growth of Internet communications and the large volume of digital data produced by the public around the world has revolutionised Open Source Intelligence (OSINT)[16] (Williams & Blum, 2018). A term that dates back to World War II when the United States began to design this intelligence[17] discipline as an instrument to support the decisions and actions of its government (Burke, 2007; Schaurer & Störger, 2013), OSINT differs from traditional intelligence in that it collects data through accessible public

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[15] *Citizen engagement will be identified through social media metrics (likes, comments, and shares) that are designed to allow information to spread quickly, be powerful, and encourage interaction between users (O'Dea et al., 2018).*

[16] *Open source intelligence is defined as 'the discipline pertaining to intelligence produced from publicly available information that is collected, exploited, and disseminated in a timely manner to an appropriate audience in order to address a specific intelligence requirement'. (National Defense Authorization Act for Fiscal Year 2006, 2006).*

[17] *It is a term of military security. 'Intelligence is information collected inside or outside the US, which may provide information not available elsewhere that warns of potential threats and opportunities'. There are six basic sources of intelligence or disciplines: HUMINT, SIGINT, IMINT, MASINT, GEOINT and OSINT (DNI, 2019).*

resources, such as social media, media, blogs, and web communities (Pellet et al., 2019).

Social media provide an important platform for disseminating open source information, including any web content, exchange of opinions, and discussions (Giordano et al., 2015), this being a source of information that surpasses a variety of other sources due to its opportunity and ease of access (Richelson, 2015). Therefore, the OSINT tools that make it possible to collect intelligence information from social media are grouped under Social Media Intelligence (SOCMINT)[18].

Thus, to address the objectives of this study, set forth above, we will apply OSINT tools in the field of SOCMINT. By gaining access without any limitation to the information published on social media, the totality of the publications of each municipality will be obtained in a few minutes automatically, regardless of the amount, thus providing credible information that contributes positively to the information analysis process to obtain conclusions from a scenario realistic. The continuous collection and delivery of reliable and accurate information can lead to accurate answers and correct strategic decisions (Pellet et al., 2019).

Background of the problem

Local governments and social media

The rapid adoption of social media applications by the public is giving way to new ways for governments to communicate and engage with citizens (Guillamón et al., 2016). When governments use social media as a communication channel, they adopt a more open and transparent profile that encourages citizens to be more willing to participate with their comments in public affairs (Bonsón et al., 2012; Mergel, 2013).

In the academic field, local governments with the largest populations are generally those selected by researchers, since these governments show greater technological advances (Mossberger et al., 2013; Reddick & Norris, 2013). However, social media, due to their open interaction platforms, are useful for improving small local governments' ability to inform and interact with citizens and the general public (Gao & Lee, 2017). Therefore, it is worth considering studying the behaviour not only of large local governments but also

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[18] *SOCMINT is a recently coined term for the confluence of ideas from open source intelligence (OSINT) and web mining technique (machine learning and database methods) applied to social media data to identify and understand human behaviour and identify situations that would affect national security, and to try to make rational decisions to bring situations to the desired state (Șușnea & Iftene, 2018).*

of small ones.

OSINT and social media

The different OSINT collection and analysis techniques are used by researchers from different areas, due to their accessibility and ability to corroborate information (Shere, 2020b). One of the main sources of OSINT information where researchers can collect publicly available information is social media (SOCMINT) (Edwards & Urquhart, 2016). SOCMINT is an increasingly important component of digital intelligence, and an important source of information (Omand, 2017). In addition, among the different disciplines or basic sources of intelligence (HUMINT, SIGINT, IMINT, MASINT, GEOINT, and OSINT), SOCMINT is the discipline that has made OSINT tools more and more accessible for citizens who simply want to track social media profiles in seeking information[19] (Shere, 2020a).

It turns out that social media presents numerous opportunities for researchers due to the large volume of useful data located in one place (Giordano et al., 2015; Hassan & Hijazi, 2018). The data available in them is not only the original content published by the user, such as text content or an uploaded image or video, but also the metadata associated with the original content, such as date/time and the geographic location associated with the published content (Perez et al., 2018).

Users are often unaware of how much information is disclosed when using social media, such as Twitter, where 'a single 140-character tweet can contain 9 kB of metadata about the user, including their followers, background, and location' (Sinnott & Sun, 2016). The results of several experiments have verified how Big Data techniques for social network analysis and data mining have been used to infer attributes of a user based on the information revealed by another user (Gil, 2016). Perez, Musolesi, and Stringhini (2018) showed that taking into account the metadata of 5 million Twitter users, it is possible to identify 10 users in a group of 10,000 with an accuracy of 99.22%. Despite this, users continue to share content via social media, though one of their main concerns regarding the Internet is privacy (Fundación Telefónica, 2019), which provides the basis for the 'paradox of privacy'[20] in the social media.

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[19] *Despite the popularity of SOCMINT, it is a discipline developed in 2012 by D. Omand, J. Bartlett, and C. Milleret, which is not yet considered an intelligence discipline.*

[20] *The privacy paradox is the discrepancy between users' intentions to protect their privacy and their actual behaviour (Barnes, 2006). There is currently an open debate in the scientific community about the*

The exploitation of information from social media is increasingly seen as relevant and profitable, raising new ethical concerns (Rønn & Søe, 2019), such as the one that has emerged after the revelation that Facebook provided personally identifiable information of more than 87 million users to Cambridge Analytica,[21] which has made it imperative to develop comprehensive privacy policy laws (Isaak & Hanna, 2018).

After this scandal, the corporations at the forefront of social media have adopted an increasingly restricted and regulated profile with access to their APIs[22] (Perriam et al., 2020). This leaves academic researchers who carry out studies with data from social media in a difficult situation, and has reduced the amount of research that uses APIs (Acker & Kreisberg, 2020).

When conducting research on social media, academics can extract the data manually or automatically. However, as technology is advancing by leaps and bounds, it does not make sense to extract data manually, as there are so many automatic tools available (Cukier & Mayer-Schoenberger, 2013). One of the most widespread automatic extraction options is the use of APIs, despite their restrictions. It has been suggested in numerous previous studies that the number of 200 tweets per user is enough to extract its characteristics (Albalawi et al., 2019; Kim et al., 2017; Sap et al., 2014; Volkova et al., 2015; Volkova & Van Durme, 2015), however, not extracting most of the data can lead to a sampling bias, to avoid which, Big Data technology can be adopted. That way, sampling is stopped when considering the entire population, emerging the concept of 'N = All' (Mayer-Schönberger & Cukier, 2013). It should be borne in mind that Perrons and McAuley (2015) suggest that to collect and analyse all the data potentially related to a case involves dealing with the economic and technical realities required, which for social media are generally relatively low costs, since much of its information is offered

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existence of this paradox. While some authors (Xie et al., 2019) do show that it is fulfilled, others indicate that they are not, since 'it shows that users behave as rational actors capable of identifying threats to their privacy and adjusting the content they publish on social networks, and also with whom they share them, consequently' (Gruzd & Hernández-García, 2018). They also suggest that 'if the different platforms are not able to address this concern, users can publish less and less detailed content, which would reduce the value of the data'.

[21] *'The data analytics company that worked with Donald Trump's electoral team and the winning Brexit campaign collected millions of profiles of American voters on Facebook, in one of the largest data breaches in the history of the tech giant, and used them to create a powerful software program to predict and influence decisions at the polls' (Cadwalladr & Graham-Harrison, 2018).*

[22] *Application programming interface (API) is the application programming interface. An API is a background interface through which external developers can connect new plugins to an existing service, and it is also an interface for researchers to collect data from a particular social media service for empirical analysis (Lomborg & Bechmann, 2014).*

voluntarily, but in some fields (such as mining) the acquisition and storage of all the data generates quite high marginal costs, so a different approach to Big data is adopted with strategies of data collection known as 'N < All'. In any case, '"N = everything is often an assumption rather than a fact about the data" (Fung, 2013), that is to say, that, ultimately, when using big data, a researcher works with data sets and analytical techniques in applications that are so large and complex that they require advanced data storage, management, analysis, and visualisation technologies (Chen et al., 2012), and involve forgoing carefully selected clean data and tolerating some clutter (Cukier & Mayer-Schoenberger, 2013).

To search for information sources and to capture all the data that allows Big Data analysis to be carried out, the OSINT methodology is used (Williams & Blum, 2018). It is possible to obtain large volumes of data through OSINT tools and techniques, since it has the advantage of accessing without limitations by referring to all the data that is publicly available as OSINT, so that they are legally accessible by the public without violation of any copyright, patent, or privacy laws (DFM Team, 2019).

It is an important factor that the researchers who collect data through OSINT keep in mind data protection laws to comply with ethical and legal issues regarding the way that personal information of citizens is collected, processed, and preserved. This legal basis is stipulated in the General Data Protection Regulation (GDPR)[23] with competences at the level of the European Union. However, Shere (2020b) argue that the GDPR is simply a first step to establish expectations and social regulations around digital privacy, since according to his survey in practice few substantial changes have occurred in the methods or analysis of OSINT as a result of the entry into force of the GDPR. Therefore, investigations applying OSINT are not affected by the GDPR, since, ultimately, from a formal point of view, the use of European regulation as a legal instrument for the unification and uniformity of the legality of the personal data regime in the EU is more theoretical than real (Martínez-Martínez, 2018).

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[23] *GDPR is the European regulation on the protection of natural persons with regard to the processing of their personal data and the free circulation of these data. It entered into force on May 25, 2016 and was applied on May 25, 2018, giving companies, organizations, agencies, and institutions two years to adapt in order to comply (Available at* https://www.boe.es/doue/2016/119/L00001-00088.pdf). *In Spain, the RGPD made the 1999 Organic Law on the Protection of Personal Data (LOPD) obsolete, and was replaced on December 6, 2018 by the 'Ley Orgánica de Protección de Datos Personales y Garantía de los Derechos Digitales' (LOPD-GDD), in accordance with the RGPD. (Available at* https://www.boe.es/buscar/doc.php?id=BOE-A-2018-16673)

This study follows all ethical and legal bases in the extraction, storage, and treatment of data. No personal information is considered, as it does not treat any data that is considered personal as defined in Article 4 of the GDRP (Regulation (EU) 2016/679, 2016):

'"personal data" means any information relating to an identified or identifiable natural person ("data subject"); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person [...]'

No profile of a natural person is analysed; the Twitter and Instagram accounts analysed are those of Andalusian local governments which by their nature are not considered private, since according to a court sentence (STSJ CLM 946/2018, 2018), the social media of public administrations are financed by public resources, so they belong to the citizens and must serve them.

The provisions of the privacy policies of the two social media networks analysed are complied with. Twitter makes it clear that '*Twitter is public and Tweets are immediately viewable and searchable by anyone around the world*' (Twitter, 2020), while Instagram facilitates research to academics '*that advances scholarship and innovation that support discovery and innovation*' (Instagram, 2020).

Furthermore, OSINT experts generally consider that information shared on social media sites belongs to the OSINT domain, because it is public information shared on public online platforms and therefore can be exploited for intelligence purposes (Hassan & Hijazi, 2018).

Problem statement and the primary research question

A considerable interest of researchers in social media (Bonsón et al., 2012; Wilson et al., 2012) translates into an extensive academic literature on the subject. Most of the studies are of a theoretical/conceptual nature, both in the analysis of the private sector (Bhimani et al., 2019) and in the analysis of the public sector (Dwivedi et al., 2017). On the other hand, our research presents both a quantitative and a qualitative analysis, to complement the few studies that collect both types of information (Tseng, 2017).

Regarding the public sector, the research focuses on the use of social media tools by

politicians at the state level, leaving a limited number of studies that cover the use of social media by leaders at the local level, such as mayors, and by institutions, such as city councils (Sobaci & Karkin, 2013). Additionally, these previous studies focus more on the analysis of social media as a tool for electoral campaigns (Jungherr, 2016), and to a lesser extent as platforms for citizen participation. Therefore, to go beyond the perception of the use of social media as a tool for political purposes, our research focuses on the use of social media as platforms for citizen engagement.

With regard to research on social media platforms, there are a large number of studies on the dissemination of Facebook and Twitter, while there are a limited number on Instagram (Blank & Lutz, 2017). Despite the numerous articles on Twitter, this research analyses this platform together with Instagram, since both cover a wider network of potential contacts than other social media such as Facebook, because both platforms (to a greater degree Twitter and continuously Instagram) present a high bridging social capital[24] (Phua et al., 2017). Both on Instagram and on Twitter there is non-reciprocal following; users can follow other people with whom they do not have a relationship, such as organisations (Jin & Phua, 2014), without the need for approval or reciprocity (Waterloo et al., 2018).

Finally, our study offers a new avenue of investigation by considering all the publications of the accounts being analysed. Previous works do not obtain 100% of the publications from social media, since they collect them manually (Bonsón et al., 2016, 2017; I. C. H. Fung et al., 2017) or automatically through APIs (Hu et al., 2014; Romero et al., 2011; Van Dam & Van De Velden, 2015).

Each social network has an API that allows information to be obtained, but with limitations and with premium (paid) versions. Twitter can only provide to 3,200 of a user's most recent Tweets (Twitter Developers, 2019), while the Instagram API is more restrictive, not to say non-existent (Murthy et al., 2016), as it only allows access to comments and posts from the user's own account, without the possibility (in the basic version) of obtaining a list of posts from other users, or obtaining a list of publications with a specific #hashtag (Facebook for developers, 2019). These limitations mean insufficient extraction, when, for example, the Twitter accounts of local governments have an average of 14,531 tweets (Bonsón et al., 2019). In other words, with the official

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[24] *A sociological term. Bridging social capital refers to weak and distant relationships between people, offering opportunities to share information, while bonding social capital applies to strong relationships that provide emotional kinship, trust, and social support (Putnam, 2000).*

Twitter API only 22% of tweets would be obtained (Pfeffer et al., 2018). Therefore, to obtain the totality of the publications, this study adopts new forms of data extraction with OSINT tools in the field of SOCMINT. These tools—Twint (Zacharias & Poldi, 2018) for Twitter, and Instaloader (Graf, 2017) for Instagram—are applied through the open source software Python (Van Rossum, 1995). Both of these advanced scraping tools are collected in the open source research toolkit[25] from the respected and innovative open source intelligence group, Bellingcat[26].

To fill in the gaps in the academic literature noted above, we pose our main research question (RQ): How do Andalusian citizens use Twitter and Instagram to engage with their local governments and how do these satisfy the informative need demanded by citizens? To our knowledge, no study has examined this issue by taking into account all of the publications. In addition, each of the three chapters provided in this dissertation presents additional research questions to complete the main one.

Theoretical framework

Research on social media has become a highly successful topic in recent years, which has resulted in a multitude of areas that produce studies, such as data science, social science, behavioural science, and information systems science (Qi et al., 2018).

In addition, research on social media can offer new contributions in various areas, such as sociology, economics, and communication (Ratkai & Bonsón, 2014), because much of the empirical research on social media has used theories from various fields, such as communication theories (Dialogic Theory), economic theories (Agency Theory), and socio-political theories (Stakeholders Theory and Legitimacy Theory).

Therefore, for the purpose of our research we have decided to answer our research question by applying these theories. The approach of combining these theories has already been implemented in previous studies (Bednárová & Bonsón, 2014; Ratkai & Bonsón, 2014), since they are not considered competitive with each other, but rather are

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[25] *Available at the website bit.ly/bcattools*

[26] *Bellingcat defines themselves as 'an independent international collective of citizen journalists and researchers that uses open source research and social media to investigate a variety of topics'. Among these topics are some for which they achieved their notoriety—they tracked social networks during the course of the covert Russian invasion in Ukraine in 2014, including the tragedy of the Malaysia Airlines passenger flight MH17 destroyed by the Russian army (Patrikarakos, 2017; Pendry, 2017)—as well as topics as current as the use of a system to categorize COVID-19 misinformation (Etim et al., 2020).*

complementary theories. Each of them will be explained and detailed in the relevant section about theoretical foundations.

Research design

This thesis is composed of three research articles that correspond to the three chapters of the thesis. Despite the fact that each article can be considered an independent research unit, they form a coherent whole, thus framing a joint research unit.

The composition of the thesis is presented in Figure 1. The research is carried out by focussing, initially, on citizens (citizen perspective), and, later, on local governments (government perspective). The first two chapters, from the perspective of the citizen, are dedicated to Twitter (Chapter 1) and Instagram (Chapter 2) as platforms for citizen engagement with local governments. After analysing and identifying what is of greatest interest to citizens in both social media networks, the last chapter is presented from the perspective of the government. This (Chapter 3) is dedicated to Twitter as a channel of environmental disclosure by local governments.

Figure 1: Argument development of the thesis
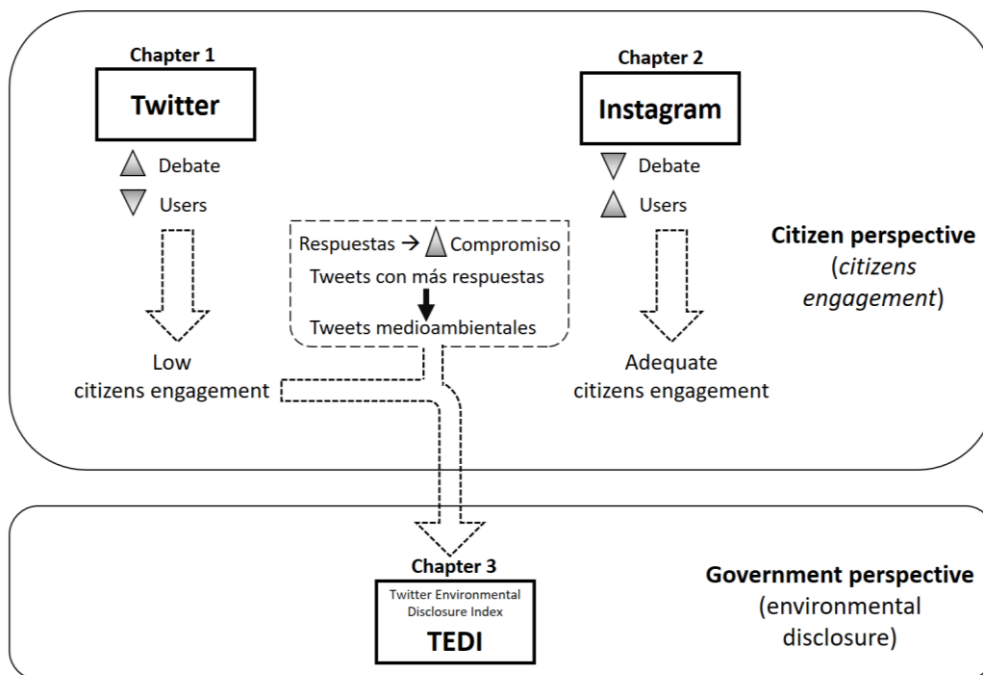
This research begins by individually analysing two very different platforms with different characteristics and different audiences. Twitter has its own characteristics to facilitate debate, and it is the most used by politicians (Marcos, 2018). On the other hand, Instagram has a higher number of users than Twitter (We are social & Hootsuite, 2020). Ultimately,

Twitter is related to informative and educational motivations, and Instagram to the presentation of a more attractive self and to entertainment (Kircaburun et al., 2020).

For both of these cases, all the publications on both Twitter and Instagram of each of the 29 most populated Andalusian municipalities (> 50,000 inhabitants) were collected and analysed. These municipalities represent more than a half of the Andalusian population (IECA, 2017).

Both scenarios are developed to analyse citizen engagement in social media. Numerous interesting findings were obtained, which are detailed in the first subsection (empirical findings) of the next section (study design). However, we highlight the low level of citizen engagement on Twitter compared to Instagram (0.57 points versus 21.25 points). Therefore, considering the engagement generated on Instagram as adequate, we focus on Twitter to see if local governments disseminate through tweets what their citizens require of them in terms of responses. Responses to tweets generate greater engagement from users, because compared to retweets and likes that are just a click away, they involve more work when writing the message (Kim & Yoo, 2012). Furthermore, unlike retweets and likes, which are usually an indication of approval, responses to tweets can be a positive or negative comment on the topic of discussion (Calais Guerra et al., 2011). Therefore, we will analyse the tweets that generate the most comments, which are tweets with environmental content.

Finally, a real vision is offered of how Andalusian local governments use Twitter to disseminate information on environmental issues, and the determining factors of such disclosure are identified. The sample is extended to the 153 Andalusian municipalities with the largest populations (>10,000 inhabitants); almost 80% of the Andalusian population resides in these municipalities (IECA, 2017). For the measurement we designed an environmental disclosure index on Twitter, the TEDI (Twitter Environmental Disclosure Index).

For the collection of the publications of both social media networks, OSINT tools have been applied in the field of SOCMINT, making it possible to obtain all the publications. The publications are analysed at two levels: the original published content and the metadata associated with it (Kujawski, 2019). As this is, to our knowledge, the first study that provides a realistic view of the use of social media by local governments, academics and practitioners can benefit from this research.

REFERENCES

Acker, A., & Kreisberg, A. (2020). Social media data archives in an API-driven world. *Archival Science*, *20*(2), 105–123. https://doi.org/10.1007/s10502-019-09325-9

Albalawi, Y., Nikolov, N. S., & Buckley, J. (2019). Trustworthy health-related tweets on social media in Saudi Arabia: Tweet metadata analysis. *Journal of Medical Internet Research*, *21*(10), e14731. https://doi.org/10.2196/14731

Barnes, S. B. (2006). A privacy paradox: Social networking in the United States. *First Monday*, *11*(9), 5. https://doi.org/10.5210/fm.v11i9.1394

Bednárová, M. (2014). *Corporate social responsibility reporting practices of Eurozone companies*. Ph.D. Thesis. Universidad de Huelva.

Bhimani, H., Mention, A. L., & Barlatier, P. J. (2019). Social media and innovation: A systematic literature review and future research directions. *Technological Forecasting and Social Change*, *144*, 251–269. https://doi.org/10.1016/j.techfore.2018.10.007

Blank, G., & Lutz, C. (2017). Representativeness of Social Media in Great Britain: Investigating Facebook, LinkedIn, Twitter, Pinterest, Google+, and Instagram. *American Behavioral Scientist*, *61*(7), 741–756. https://doi.org/10.1177/0002764217717559

Bonsón, E., Bednárová, M., & Wei, S. (2016). *Corporate Twitter use and stakeholder engagement: An empirical analysis of the Spanish hotel industry*. https://search.proquest.com/openview/f903aaf5c9c836290e8471d27f20cd01/1?pq-origsite=gscholar&cbl=55001

Bonsón, E., Perea, D., & Bednárová, M. (2019). Twitter as a tool for citizen engagement: An empirical study of the Andalusian municipalities. *Government Information Quarterly*. https://doi.org/10.1016/J.GIQ.2019.03.001

Bonsón, E., Royo, S., & Ratkai, M. (2017). Facebook Practices in Western European Municipalities. *Administration & Society*, *49*(3), 320–347. https://doi.org/10.1177/0095399714544945

Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, *29*(2), 123–132. https://doi.org/10.1016/J.GIQ.2011.10.001

Burke, C. (2007). Freeing knowledge, telling secrets: Open source intelligence and development. *Research Paper Series: Centre for East-West Cultural & Economic Studies. Bond University*, *13*, 1–22. http://epublications.bond.edu.au/cewces_papers

Cadwalladr, C., & Graham-Harrison, E. (2018, March 17). Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach. *The Guardian*. https://www.theguardian.com/news/2018/mar/17/...

Calais Guerra, P. H., Veloso, A., Meira, W., & Almeida, V. (2011). From bias to opinion: A transfer-learning approach to real-time sentiment analysis. *Proceedings of the 17th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, 150–158. https://doi.org/10.1145/2020408.2020438

Chen, H., Chiang, R. H. L., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly: Management Information Systems*, *36*(4), 1165–1188. https://doi.org/10.2307/41703503

Cukier, K., & Mayer-Schoenberger, V. (2013). The Rise of Big Data How It's Changing the

Way We Think About the World. *Foreign Affairs*, *92*.

DFM Team. (2019). Social Media Intelligence (SOCMINT). *Digital Forensics Magazine*, *38*. https://www.digitalforensicsmagazine.com/index.php?option=com_content&view=article &id=1277&Itemid=72

DNI, D. of N. I. (2019). *What is Intelligence?* Office of the Director of National Intelligence. https://www.dni.gov/index.php/what-we-do/what-is-intelligence

Dwivedi, Y. K., Rana, N. P., Tajvidi, M., Lal, B., Sahu, G. P., & Gupta, A. (2017). Exploring the role of social media in e-government: An analysis of emerging literature. *ACM International Conference Proceeding Series*, *Part F128003*, 97–106. https://doi.org/10.1145/3047273.3047374

Edwards, L., & Urquhart, L. (2016). Privacy in public spaces: What expectations of privacy do we have in social media intelligence? *International Journal of Law and Information Technology*, *24*(3), 279–310. https://doi.org/10.1093/ijlit/eaw007

Etim, G. L., Iyamu, I., & Chinwuba, C. C. (2020). Analytical Approach to Ascertain the Origin of Different Kinds of News on Corona Virus (Covid-19) Pandemic across Social Media. *International Journal of Innovative Science and Research Technology*, *5*(5). www.ijisrt.com

Regulation (EU) 2016/679, (2016). https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016R0679&from=EN

Facebook for developers. (2019). *Instagram Basic Display API*. Facebook for Developers. https://developers.facebook.com/docs/instagram-basic-display-api

Fundación Telefónica. (2019). *Sociedad Digital en España 2018*. https://www.fundaciontelefonica.com/cultura-digital/publicaciones/sociedad-digital-en-espana-2018/655/

Fung, I. C. H., Blankenship, E. B., Goff, M. E., Mullican, L. A., Chan, K. C., Saroha, N., Duke, C. H., Eremeeva, M. E., Fu, K. W., & Tse, Z. T. H. (2017). Zika-Virus-Related Photo Sharing on Pinterest and Instagram. *Disaster Medicine and Public Health Preparedness*, *11*(6), 656–659. https://doi.org/10.1017/dmp.2017.23

Fung, K. (2013). *Numbersense : how to use big data to your advantage* (Illustrated edition). McGraw-Hill Education. https://www.worldcat.org/title/numbersense-how-to-use-big-data-to-your-advantage/oclc/857713322

Gao, X., & Lee, J. (2017). E-government services and social media adoption: Experience of small local governments in Nebraska state. *Government Information Quarterly*, *34*(4), 627–634. https://doi.org/10.1016/j.giq.2017.09.005

Gil, E. (2016). *Big data, privacidad y protección de datos*. Agencia Estatal Boletín Oficial del Estado.

Giordano, A., Spezzano, G., Sunarsa, H., & Vinci, A. (2015). Twitter to integrate human and Smart Objects by a Web of Things architecture. *Proceedings of the 2015 IEEE 19th International Conference on Computer Supported Cooperative Work in Design, CSCWD 2015*, 355–361. https://doi.org/10.1109/CSCWD.2015.7230985

Graf, A. (2017). *Instaloader*. https://instaloader.github.io/

Gruzd, A., & Hernández-García, Á. (2018). Privacy Concerns and Self-Disclosure in Private and Public Uses of Social Media. *Cyberpsychology, Behavior, and Social Networking*,

21(7), 418–428. https://doi.org/10.1089/cyber.2017.0709

Guillamón, M. D., Ríos, A. M., Gesuele, B., & Metallo, C. (2016). Factors influencing social media use in local governments: The case of Italy and Spain. *Government Information Quarterly*, *33*(3), 460–471. https://doi.org/10.1016/J.GIQ.2016.06.005

Hassan, N. A., & Hijazi, R. (2018). Open Source Intelligence Methods and Tools. A Practical Guide to Online Intelligence. In *Open Source Intelligence Methods and Tools* (1st ed.). Apress. https://doi.org/10.1007/978-1-4842-3213-2

Hu, Y., Manikonda, L., & Kambhampati, S. (2014). What We Instagram: A First Analysis of Instagram Photo Content and User Types. In *Eighth International AAAI Conference on Weblogs and Social Media*. www.aaai.org

IECA, I. de E. y C. de A. (2017). *Padrón Municipal de Habitantes. Cifras oficiales de población municipal.* https://www.juntadeandalucia.es/institutodeestadisticaycartografia/badea/informe/anual?CodOper=b3_128&idNode=7488

Instagram. (2020, August 21). *Data Policy*. Help Center. https://www.facebook.com/help/instagram/519522125107875

Isaak, J., & Hanna, M. J. (2018). User Data Privacy: Facebook, Cambridge Analytica, and Privacy Protection. *Computer*, *51*(8), 56–59. https://doi.org/10.1109/MC.2018.3191268

Jin, S. A. A., & Phua, J. (2014). Following celebrities' tweets about brands: The impact of Twitter-based electronic word-of-mouth on consumers source credibility perception, buying intention, and social identification with celebrities. *Journal of Advertising*, *43*(2), 181–195. https://doi.org/10.1080/00913367.2013.827606

Jungherr, A. (2016). Twitter use in election campaigns: A systematic literature review. In *Journal of Information Technology and Politics* (Vol. 13, Issue 1, pp. 72–91). Routledge. https://doi.org/10.1080/19331681.2015.1132401

Kim, A., Miano, T., Chew, R., Eggers, M., & Nonnemaker, J. (2017). Classification of Twitter Users Who Tweet About E-Cigarettes. *JMIR Public Health and Surveillance*, *3*(3), e63. https://doi.org/10.2196/publichealth.8060

Kim, J., & Yoo, J. (2012). Role of sentiment in message propagation: Reply vs. retweet behavior in political communication. *Proceedings of the 2012 ASE International Conference on Social Informatics, SocialInformatics 2012*, 131–136. https://doi.org/10.1109/SocialInformatics.2012.33

Kircaburun, K., Alhabash, S., Tosuntaş, Ş. B., & Griffiths, M. D. (2020). Uses and Gratifications of Problematic Social Media Use Among University Students: a Simultaneous Examination of the Big Five of Personality Traits, Social Media Platforms, and Social Media Use Motives. *International Journal of Mental Health and Addiction*, *18*(3), 525–547. https://doi.org/10.1007/s11469-018-9940-6

Kujawski, M. (2019, February 26). *Basic Social Media Intelligence (SOCMINT) Tools To Help Fight Disinformation*. Medium. https://medium.com/@mikekujawski/basic-social-media-intelligence-socmint-tools-to-help-fight-disinformation-c43563f3d95f

Marcos, S. (2018). *Las redes sociales como herramienta de la comunicación política. Usos políticos y ciudadanos de Twitter e Instagram* [Universitat Jaume I]. https://doi.org/10.6035/14111.2018.253296

Martínez-Martínez, D.-F. (2018). Unification of personal data protection in the European

Union: Challenges and implications. *El Profesional de La Información*, *27*(1), 185. https://doi.org/10.3145/epi.2018.ene.17

Mayer-Schönberger, V., & Cukier, K. (2013). *Big Data: A Revolution that Will Transform how We Live, Work, and Think*. Houghton Mifflin Harcourt. https://books.google.es/books?hl=es&lr=&id=uy4lh-WEhhIC&oi=fnd&pg=PP1&dq=Big+Data+A+Revolution+That+Will+Transform+How+We+Live,+Work,+and+Think&ots=Juc7eoCUHS&sig=n9dcKCmyCFlONGKTqnE38Va wrSM#v=onepage&q=Big Data A Revolution That Will Transform How We Live%2C Work%2C and Think&f=false

Merchant, R. M., & Lurie, N. (2020). Social Media and Emergency Preparedness in Response to Novel Coronavirus. *JAMA*. https://doi.org/10.1001/jama.2020.4469

Mergel, I. (2013). Social Media in the Public Sector: A guide to Participation, Collaboration, and Transparency in the Networked World. *Gestión y Política Pública*, *22*, 338–343.

Mossberger, K., Wu, Y., & Crawford, J. (2013). Connecting citizens and local governments? Social media and interactivity in major U.S. cities. *Government Information Quarterly*, *30*(4), 351–358. https://doi.org/10.1016/j.giq.2013.05.016

Murthy, D., Gross, A., & McGarry, M. (2016). Visual Social Media and Big Data. Interpreting Instagram Images Posted on Twitter. *Digital Culture & Society*, *2*(2), 113–134. https://doi.org/10.14361/dcs-2016-0208

O'Dea, B., Achilles, M. R., Larsen, M. E., Batterham, P. J., Calear, A. L., & Christensen, H. (2018). The rate of reply and nature of responses to suicide-related posts on Twitter. *Internet Interventions*, *13*, 105–107. https://doi.org/10.1016/j.invent.2018.07.004

Omand, D. (2017). Social Media Intelligence (SOCMINT). In *The Palgrave Handbook of Security, Risk and Intelligence* (pp. 355–371). Palgrave Macmillan. https://doi.org/10.1057/978-1-137-53675-4_20

Omand, D., Bartlett, J., & Miller, C. (2012). Introducing social media intelligence (SOCMINT). *Intelligence and National Security*, *27*(6), 801–823. https://doi.org/10.1080/02684527.2012.716965

Patrikarakos, D. (2017). *War in 140 characters : how social media is reshaping conflict in the twenty-first century* (First edition.). Basic Books.

Pellet, H., Shiaeles, S., & Stavrou, S. (2019). Localising social network users and profiling their movement. *Computers and Security*, *81*, 49–57. https://doi.org/10.1016/j.cose.2018.10.009

Pendry, R. (2017). Partiality, patriotism and propaganda: Aggregating local news sources in Ukraine. In *Representing Communities, Discourse and Contexts* (pp. 199–216). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-65030-2_11

Perez, B., Musolesi, M., & Stringhini, G. (2018). You are your metadata: Identification and obfuscation of social media users using metadata information. *12th International AAAI Conference on Web and Social Media, ICWSM 2018*, 241–250. www.aaai.org

Perriam, J., Birkbak, A., & Freeman, A. (2020). Digital methods in a post-API environment. *International Journal of Social Research Methodology*, *23*(3), 277–290. https://doi.org/10.1080/13645579.2019.1682840

Perrons, R. K., & McAuley, D. (2015). The case for "n«all": Why the Big Data revolution will probably happen differently in the mining sector. *Resources Policy*, *46*, 234–238. https://doi.org/10.1016/j.resourpol.2015.10.007

Pfeffer, J., Mayer, K., & Morstatter, F. (2018). Tampering with Twitter's Sample API. *EPJ Data Science*, *7*(1), 50. https://doi.org/10.1140/epjds/s13688-018-0178-0

Phua, J., Jin, S. V., & Kim, J. (Jay). (2017). Uses and gratifications of social networking sites for bridging and bonding social capital: A comparison of Facebook, Twitter, Instagram, and Snapchat. *Computers in Human Behavior*, *72*, 115–122. https://doi.org/10.1016/J.CHB.2017.02.041

Putnam, R. D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. Simon & Schuster. http://bowlingalone.com/

Qi, J., Monod, E., Fang, B., & Deng, S. (2018). Theories of Social Media: Philosophical Foundations. *Engineering*, *4*(1), 94–102. https://doi.org/10.1016/j.eng.2018.02.009

Ratkai, M. (2014). *Corporate social media as a tool for voluntary reporting, transparency and stakeholder's engagement in Western European local governments* [Universidad de Huelva]. http://rabida.uhu.es/dspace/handle/10272/9845

Reddick, C. G., & Norris, D. F. (2013). Social media adoption at the American grass roots: Web 2.0 or 1.5? *Government Information Quarterly*, *30*(4), 498–507. https://doi.org/10.1016/j.giq.2013.05.011

Richelson, J. T. (2015). *The U.S. intelligence community* (7th ed.). Routledge.

Romero, D. M., Meeder, B., & Kleinberg, J. (2011). Differences in the mechanics of information diffusion across topics: Idioms, political hashtags, and complex contagion on twitter. *Proceedings of the 20th International Conference on World Wide Web, WWW 2011*, 695–704. https://doi.org/10.1145/1963405.1963503

Rønn, K. V., & Søe, S. O. (2019). Is social media intelligence private? Privacy in public and the nature of social media intelligence. *Intelligence and National Security*, *34*(3), 362–378. https://doi.org/10.1080/02684527.2019.1553701

Sap, M., Park, G., Eichstaedt, J. C., Kern, M. L., Stillwell, D., Kosinski, M., Ungar, L. H., & Schwartz, H. A. (2014). Developing age and gender predictive lexica over social media. *EMNLP 2014 - 2014 Conference on Empirical Methods in Natural Language Processing, Proceedings of the Conference*, 1146–1151. https://doi.org/10.3115/v1/d14-1121

Schaurer, F., & Störger, J. (2013). Guide to the Study of Intelligence The Evolution of Open Source Intelligence (OSINT). *Journal of U.S. Intelligence Studies*, *19*(3), 53–56. http://blogs.ethz.ch/osint/files/2010/08/nato-osint-handbook-

Shere, A. (2020a). Reading the Investigators Their Rights: A review of literature on the General Data Protection Regulation and open-source intelligence gathering and analysis. *Source: The New Collection*, *14*, 3–21.

Shere, A. (2020b). Now you [don't] see me: how have new legislation and changing public awareness of the UK surveillance state impacted OSINT investigations? *Journal of Cyber Policy*, 1–20. https://doi.org/10.1080/23738871.2020.1832129

Sinnott, R. O., & Sun, S. (2016). Spatial Privacy Challenges in Social Networks. In *Big Data: Principles and Paradigms* (pp. 269–283). Elsevier Inc. https://doi.org/10.1016/C2015-0-04136-3

Sobaci, M. Z., & Karkin, N. (2013). The use of twitter by mayors in Turkey: Tweets for better public services? *Government Information Quarterly*, *30*(4), 417–425. https://doi.org/10.1016/j.giq.2013.05.014

Șușnea, E., & Iftene, A. (2018). The Significance of Online Monitoring Activities for the Social Media Intelligence (SOCMINT). *Mathematical Foundations of Informatics*, 230–240. http://www.math.md

STSJ CLM 946/2018, Pub. L. No. 00083/2018 (2018). http://www.poderjudicial.es/search/contenidos.action?action=contentpdf&databasematch=AN&reference=8421577&links=%2283/2018%22&optimize=20180618&publicinterface=true

Tseng, M. L. (2017). Using social media and qualitative and quantitative information scales to benchmark corporate sustainability. *Journal of Cleaner Production*, *142*, 727–738. https://doi.org/10.1016/j.jclepro.2016.05.062

Twitter. (2020, June 18). *Privacy Policy*. https://twitter.com/en/privacy

Twitter Developers. (2019). *GET statuses/user_timeline*. Twitter Developers. https://developer.twitter.com/en/docs/tweets/timelines/api-reference/get-statuses-user_timeline

National Defense Authorization Act for Fiscal Year 2006., Pub. L. No. Sec. 931, 109th Congress Public Law 163 277 (2006).

Van Dam, J. W., & Van De Velden, M. (2015). Online profiling and clustering of Facebook users. *Decision Support Systems*, *70*, 60–72. https://doi.org/10.1016/j.dss.2014.12.001

Van Rossum, G. (1995). *Python tutorial* (Issue CS-R9526).

Volkova, S., & Van Durme, B. (2015). Online bayesian models for personal analytics in social media | Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence. *Twenty-Ninth AAAI Conference on Artificial Intelligence*, 2325–2331. https://dl.acm.org/doi/10.5555/2886521.2886644

Volkova, S., Van Durme, B., Yarowsky, D., & Bachrach, Y. (2015). Social Media Predictive Analytics. *Proceedings of the 2015 Conference of the North {A}merican Chapter of the Association for Computational Linguistics: Tutorial Abstracts*, 9. https://doi.org/10.3115/v1/N15-4005

Waterloo, S. F., Baumgartner, S. E., Peter, J., & Valkenburg, P. M. (2018). Norms of online expressions of emotion: Comparing Facebook, Twitter, Instagram, and WhatsApp. *New Media & Society*, *20*(5), 1813–1831. https://doi.org/10.1177/1461444817707349

We are social, & Hootsuite. (2020). *Digital 2020* . https://wearesocial.com/digital-2020

Williams, H. J., & Blum, I. (2018). *Defining Second Generation Open Source Intelligence (OSINT) for the Defense Enterprise*. www.rand.org/t/RR1964

Wilson, R. E., Gosling, S. D., & Graham, L. T. (2012). A Review of Facebook Research in the Social Sciences. *Perspectives on Psychological Science : A Journal of the Association for Psychological Science*, *7*(3), 203–220. https://doi.org/10.1177/1745691612442904

Xie, W., Fowler-Dawson, A., & Tvauri, A. (2019). Revealing the relationship between rational fatalism and the online privacy paradox. *Behaviour and Information Technology*, *38*(7), 742–759. https://doi.org/10.1080/0144929X.2018.1552717

Zacharias, C., & Poldi, F. (2018). *TWINT - Twitter Intelligence Tool* (Python). GitHub. https://github.com/twintproject/twint

CHAPTER 1

TWITTER AS A TOOL FOR CITIZEN ENGAGEMENT: AN EMPIRICAL STUDY OF THE ANDALUSIAN MUNICIPALITIES

Abstract

This paper provides a general overview of the way local governments use Twitter as a communication tool to engage with their citizens. More concretely, it tries to identify factors associated with both the channel activity and citizen engagement, to understand the relationship between media type and citizen engagement and to analyse whether different content generated different levels of engagement. A sample of the 29 most populated Andalusian local governments is examined.

The results show that the majority of Andalusian local governments have an official corporate Twitter account with certain level of activity. There is no, however, a significant relationship between the population of a municipality and its citizen's engagement, and there is a significant negative relationship between audience and engagement and between activity and engagement. The findings of the study also show the particular media and content types generate higher engagement than others. This paper contributes to the literature on social media and has practical implications for local governments.

Keywords: Local government, Social media, Twitter, Citizen engagement, Media and content types

1.1. INTRODUCTION

Social media (SM) plays an important role in modern society. Over the past decade, governments have also adopted this tool as a new method of communication and engagement with their citizens (Guillamón, Ríos, Gesuele, & Metallo, 2016). These new applications provide an opportunity for dialogic communication (Bonsón, Torres, Royo, & Flores, 2012; Kavanaugh et al., 2012) where, for a relatively low cost, a large amount of information reaching a wide audience can be published in real time (Bonsón, Royo, & Ratkai, 2015). Bonsón et al. (2012) argue that SM may not only enhance the transparency of public administration but may also improve policy-making and the provision of public services and facilitate knowledge management in local governments.

Previous studies highlight the common features of SM such as participation, openness, conversation, connectivity, and engagement (Eltantawy & Wiest, 2011; Feroz Khan, Young Yoon, Kim, & Woo Park, 2014; Zheng & Zheng, 2014). In the public sector, the term 'engagement' refers to citizens' participation in social issues (Gil de Zúñiga, Jung, & Valenzuela, 2012), so the scope of citizen engagement is understood to include social capital, civic engagement, and political participation (Skoric, Zhu, Goh, & Pang, 2016). SM can therefore be seen as a tool to boost citizen engagement through communication, discussion, and the coordination of public and social activities (Criado, Sandoval-Almazan, & Gil-Garcia, 2013; Warren, Sulaiman, & Jaafar, 2014). Indeed, Eltantawy and Wiest (2011) point out that the true potential of SM is to provide the support to the citizens and the public sphere.

This study focuses on Twitter because it is the largest micro-blogging site and the second-largest SM platform used in business (Alexa, 2018). It is not only a SM platform where users can connect with their family, friends, or co-workers; it also offers companies the opportunity to interact with different types of individuals and allows them to broadcast information (Bonsón, Bednárová, & Wei, 2016). Twitter is also recognised for its ability to reach a large number of stakeholders, allowing organisations to use it for the purposes of public relations, advertising, and marketing campaigns (Stelzner, 2018). In the past, Twitter experienced a steady growth, while recently the number of active users is rather stable. Nevertheless, this microblogging site has created a great community that, for now, shows a strong loyalty (Sánchez, 2018).

However, the literature on Twitter in the public sector and, in particular, at the municipal

level is quite scarce, focusing more on the analysis of Twitter as a tool for electoral campaigns. There is therefore a need to analyse Twitter as a platform for citizen engagement and to go beyond its perception as a tool only for political purposes. The availability of automated tools and powerful computing techniques allows us to examine the phenomenon of engagement, to determine its current status, and to analyse it from a citizen's perspective. Several authors have pointed out the importance of future research focusing on the qualitative aspect of what local entities do on SM to assess the real impact of SM on government-to-citizen (G2C) relationships (Bonsón et al., 2012; Norris & Reddick, 2013). The objective of this paper is therefore to measure the impact of Twitter use by local governments (municipalities) in the Andalusia region (Spain)on citizen engagement and the effect of different media and content types on that engagement. This paper tries to answer the following questions: (1) To what extent do municipalities use Twitter as a communication channel to engage with their citizens? (2) What factors influence citizen engagement on Twitter?

At a global level, the United States is no longer a leader in SM usage. Regions such as EMEA (Europe, Middle East and Africa) or Latin America have gained much ground (ReasonWhy, 2018). Yet, in terms of the ways and purposes of SM use in both private and public sector, significant differences might be observed between these regions. Those might be explained by Hofstede`s cultural dimensions` theory (Hofstede Insights, 2017). Since over the last decade, the studies on SM have centred predominantly on the US, this shift makes it interesting for academics and practitioners to explore the practices of Twitter use in the public sector in other regions too.

At a European level, 68% of Spaniards habitually use social networks while the European average stands at 65% (European Commission, 2018). At the same time, Spain is the second country with the highest Twitter usage (Statistic, 2018).

For the development of this research, the Twitter practices of the main 29 Andalusian municipalities are analysed (28 out of 29 have an official Twitter account for public administration). This sample was used because Andalusia is the region with the highest population in Spain. The Andalusian population represents 18% of the entire Spanish population, and more than half of Andalusians reside in those 29 municipalities (INE, 2017).Another reason for choosing this sample was that Andalusia is a leading Spanish region in the use of SM (Fundación Orange, 2014; Fundación Telefónica, 2016). Three

of its cities, Seville, Granada and Malaga, are among the five Spanish cities with the most profiles registered on SM by number of inhabitants (The Social Media Family, 2018).

To our best knowledge, this is the first study providing a general overview of Twitter usage by Andalusian local governments by offering insights into the correlations related to the municipality characteristics and Twitter metrics such as the published tweets, the number of followers and the citizens' engagement (retweets, replies, likes). Therefore, due to the lack of empirical studies which would help local governments to integrate academic research into the municipality's communication strategy, we believe that our paper might have implications for both research and practice as it offers the overview of how the Andalusian municipalities use Twitter and what factors influence its usage and the responsiveness of citizens.

To gain the attention of citizens and boost their participation, a good strategy might be to understand what content and media types appeal most to them (Bonsón et al., 2015).It turns out that a particular content or media type might be more engaging than others (Bonsón & Bednárová, 2018).Hence, identifying those content and media types together with a comprehensive plan on how to maintain a fluid conversation with citizens, addressing their complaints, suggestions and needs, will increase the quality of public services offered (Junta de Castilla y León, 2012). Once the strategy and objectives are identified, guidelines should be established to give the management an operating tool to run SM communication. If done correctly, it is a win- win strategy where both sides, government and citizens, benefit.

This study represents an analysis that addresses both quantitative and qualitative data. This type of mixed methodology has proven effective in previous research(Hernández Sampieri, Fernández Collado, & Baptista Lucio, 2010). Our study is based on quantitative methods, since we focus on the statistical analysis of the metrics related to followers (retweets, replies, likes) to understand the level of engagement, as well as a qualitative analysis to identify the content of the tweet and the media type. The obtained results are validated by the robustness of our study, as the analysis has taken into account almost all of each user's tweets since they started their account.

Therefore, the objectives of this paper are to identify the factors associated with the citizen engagement on Twitter, to analyse whether different content and media generated different levels of engagement and whether there was a significant relationship between

them, and to confirm, through multivariate statistics applying the generalised linear model (GLM) (Welch's ANOVA tests), if the media and content types are associated with citizen engagement.

After offering a brief introduction in this first section, the rest of the article is organised as follows: in section 2 we present a review of previous studies related to the use of SM in the public sector. The data used in the research and the methodology followed are explained in section 3. Section 4 presents the findings about citizen engagement in Andalusian municipalities. Finally, the main conclusions and avenues for future research are discussed in section 5.

1.2. LITERATURE REVIEW, THEORY AND FACTORS INFLUENCING ENGAGEMENT

1.2.1. Literature Review

1.2.1.1. Social Media for public administration

The adoption of SM by governments has attracted the attention of academics and much research on this subject has been conducted (Abdelsalam, Reddick, Gamal, & Al-shaar, 2013; Bonsón & Bednárová, 2018; Bonsón, Bednarova, & Escobar-Rodríguez, 2014; Bonsón, Royo, & Ratkai, 2017; Bonsón, Torres, Royo, & Flores, 2012; Ellison & Hardey, 2014; Graham & Avery, 2013; Guillamón, Ríos, Gesuele, & Metallo, 2016; Hofmann, Beverungen, Räckers, & Becker, 2013; Oliveira & Welch, 2013; Panagiotopoulos, Bigdeli, & Sams, 2014) following diverse methodologies (Criado et al., 2013).

Previous research (Bertot, Jaeger, & Grimes, 2010; Bertot, Jaeger, Munson, & Glaisyer, 2010; Bonsón et al., 2012; Chun, Shulman, Sandoval, & Hovy, 2010) claim that SM can contribute to the improvement of public services in terms of transparency, participation, engagement, and communication. These conclusions are in agreement with diverse theories such as the agency theory (Jensen & Meckling, 1976), the theory of legitimacy (Suchman, 1995), stakeholder theory (Freeman, 1984), and the dialogic communication theory of Kent and Taylor (1998, 2002).

Previous studies found similar traits of citizen's engagement on SM at different levels of public sector (Krishnan, Teo, & Lymm, 2017; Ríos, Benito, & Bastida, 2017). In this study, we focus on the utility of SM (focusing on citizen engagement) at the local level, and the literature on these aspects has been analysed. Several authors(Bonsón & Ratkai,

2013; Bonsón et al., 2017; Sáez Martín, Haro de Rosario, & Caba Pérez, 2015; Wattal, Schuff, Mandviwalla, & Williams, 2010)have pointed out the importance of SM as a key tool to boost communication and dialogue with citizens to improve their satisfaction and commitment.

According to Haro de Rosario et al. (2018), Facebook and Twitter are the optimal SM to function as new local discussion forums; these platforms may become the new channels for local governments to send local service–related messages to their citizens or may serve as information exchange platforms or tools to obtain feedback from citizens. Incorporating SM into the local administration communication strategy may enhance the transparency and improve policy-making and the provision of public services (Bonsón et al., 2012).

Yet, depending on the cultural context, people and governments in different countries adopt SM differently(Waters & Lo, 2012). Western governments understand that SM offer an important means to restore trust in government and ensure that services respond to the needs and aspirations of citizens (Bovaird, 2017), while eastern governments adopt and use them primarily for self-promotion and political marketing instead of transparent, participatory and citizen-oriented public services (Sobaci & Karkin, 2013; Zheng & Zheng, 2014).

Despite the evidence (Gil de Zúñiga et al., 2012) that SM is being adopted to promote the citizen engagement, the research on this topic remains rather limited. While various metrics have been proposed to measure citizen engagement on Facebook and YouTube (Bonsón & Bednárová, 2018; Bonsón et al., 2014; Warren et al., 2014) including some comparative studies (Agostino, 2013; Haro-De-Rosario et al., 2018; Snead, 2013), very few studies, except Sobaci & Karkin's (2013), have been conducted to measure citizen engagement on Twitter

1.2.1.2. Twitter for public administration

The literature on Twitter and its use by local governments at the municipal level is rather scarce, as most recent studies focus on government use at the national level (Sobaci & Karkin, 2013). Although there are a few studies on Twitter and its use at the local level, they do not cover citizen engagement, but rather analyse the platform as a tool for election campaigns (Criado, Martínez-Fuentes, & Silván, 2012; Mambrey & Dörr, 2011; Pole &

Xenos, 2011). However, understanding voter`s behaviour on Twitter provides important and highly relevant information for the future management and governance of successful political campaigns (Chen, Wang, & Sheth, 2012; Grover, Kar, Dwivedi, & Janssen, 2018; Kahne & Bowyer, 2018; Smailovic, Kranjc, Grcar, Znidarsic, & Mozetic, 2015).

Examining the literature on Twitter, we can conclude the following:

i.   The literature on the use of Twitter in public administration is rather scarce.

ii. Studies on the use of Twitter in public administration tend to focus more on the national and international level, leaving the local level unexplored.

iii. Many studies related to the use of Twitter focus on political campaigns under the umbrella of political communication.

iv. Previous literature has mostly investigated the case of the USA. There is thus a lack of literature exploring this phenomenon in other regions, such as Europe.

v.   There is a lack of studies analysing citizen engagement on Twitter.

Although the character limitation (280 characters) on Twitter might be seen as a drawback, Kim, Chun, Kwak, and Nam (2014) argue that short messages can be published more frequently and their content might reach a broader audience.

In addition, Twitter is an innovative medium with open and horizontal networks (Honeycutt & Herring, 2009; Lerman & Ghosh, 2010), which gives users unprecedented access to a large number of followers and content. It is a platform where users can freely express their opinions (Grover, Kar & Davies, 2018). Thus, Twitter seems to be an ideal social network to build citizens' engagement. According to several authors (Ellison & Hardey, 2014; Y. Kim, Hsu, & de Zúñiga, 2013; Warren et al., 2014; Zhang, Johnson, Seltzer, & Bichard, 2010) the use of SM is positively related to greater citizens' engagement. Nevertheless, Bonsón et al., (2017) argue that a simple presence on SM is not enough. To maximise the benefits of this phenomenon, local governments must clearly define their online communication strategy and encourage two-way communication between the local authorities and citizens to enhance citizen engagement. Similarly, Skoric, Zhu, Goh, and Pang (2016) claim that although there is evidence of a relationship between the use of SM and participation, citizen engagement is a more complex phenomenon.

1.2.1.3. Engagement

The definition of citizens' engagement is a wide concept. By using this term, academics or professionals might refer to: public participation, public engagement, stakeholder involvement, co-creation, political participation, civic engagement, participatory democracy or activism (Carpini, Cook, & Jacobs, 2004; Y. Kim et al., 2013; Nabatchi & Amsler, 2014; Rowe & Frewer, 2000; Siebers, Gradus, & Grotens, 2018; Warren et al., 2014).To a certain extent, citizens` engagement has been defined as individual or collective behaviour aimed at resolving social problems in the community (Gil de Zúñiga et al., 2012; Warren et al., 2014; Zukin, Keeter, Andolina, Jenkins, & Carpini, 2006).

Although there is no clear definition for the citizens' engagement, the essence of it is in the interaction between citizens and government (Ekman & Amnå, 2012).Given the important role it plays in public service delivery, the citizens' engagement is a complex phenomenon that deserves further studies(Siebers et al., 2018; Suebvises, 2018; Franklin & Ebdon, 2002).

1.2.2. Factors influencing engagement

The main purpose of our study was to provide a general overview of how the municipalities use Twitter to interact with their citizens. Furthermore, we aimed to find out which factors influence citizens` engagement considering the following: municipality`s size, Twitter activity, audience, content and media type. The last two being the main aspects addressed by this study. Thus, five research questions were formulated based on the identified factors.

Previous empirical research (Bonsón et al., 2017) points out that a large number of inhabitants does not necessarily lead to higher citizen engagement. This may be due to the sense of belonging felt by citizens in small municipalities, which generates a feeling of community participation and leads to higher engagement. To examine this phenomenon, our second research question was formulated:

RQ1: Does a municipality's size influence its citizen engagement on Twitter?

According to Mergel (2013), if a government aims to achieve a high level of citizen engagement, it must go beyond mere publication of content. Instead, citizens should be encouraged to comment and actively participate on SM platforms dedicated to public issues. Similarly, Münchener Kreis (2013) and Zavattaro and Sementelli (2014) claim

that a one-way communication model on SM does not boost interaction, so it cannot lead to an engaged society. Nevertheless, previous research (Mergel, 2013; Zafiropoulos, Antoniadis, & Vrana, 2014) has shown that, despite its potential to form a more engaged society, SM in public administration is still inclined towards a unidirectional communication model and that interaction levels are rather low.

When it comes to activity on SM, according to Bonsón, Royo, and Ratkai (2017), there is no relationship between the level of government activity on SM and citizen engagement. An increase in the number of publications does not necessarily lead to higher levels of citizen engagement. We therefore aimed to find out whether there is a statistically significant correlation between activity on the Twitter channel (measured by the number of tweets) and stakeholder engagement. Our third research question was therefore formulated:

RQ2: Does activity on Twitter influence citizen engagement?

Some previous studies on government use of SM suggest that there is no relationship between audience share and citizen engagement (Bonsón et al., 2017; Ma, 2013). Greater engagement in smaller municipalities can be explained by the argument that in smaller SM communities, followers feel closer to the municipality because they see that their opinion matters, which encourages them to interact more with the municipality. We therefore aimed to explore this phenomenon on Twitter and formulated our fourth research question:

RQ3: Does the audience influence citizen engagement?

SM allows diverse multimedia content to be published, including images, videos, or hyperlinks. The importance of media for conveying information has been highlighted by several academics (Davison, 2007; Graves, Flesher, & Jordan, 1996; Phillips, Hageman, Cho, Phillips, & Patten, 2009). They argue that plain text is no longer the best type of medium to articulate information and that multimedia content is the most powerful communication tool enhancing the potency of a given message.

Media analyses of Facebook publications from three German local governments by Hofmann et al. (2013) and from fifteen European local governments by Bonsón et al. (2015) conclude that the use of pictures encourages citizen interaction, with more likes and comments, in comparison to text-only publications. Similarly, a media analysis study

on Twitter (Zavattaro, French, & Mohanty, 2015) also suggests that messages with an additional layer of richness, such as images and photos, tend to have a greater response from citizens. We therefore aimed to explore whether different types of media, depending on their degree of richness, led to different levels of citizen engagement:

RQ4: Does media type influence citizen engagement?

Previous research (Grover & Kar, 2018; Feroz Khan et al., 2014; Graham & Avery, 2013; Halpern & Katz, 2012) has shown a relationship between content type published on SM and citizen engagement, but little is known about how different content types affect citizen engagement on public sector Twitter accounts.

We therefore aimed to find out whether proxies for citizen engagement, such as the number of favourites, replies, and retweets, depend on particular tweet content types. The content type has been classified into six categories, which are defined in the methodology section. We also seek to identify which content types lead to higher levels of citizen engagement.

In several studies the content type that generated higher levels of citizen participation were publications on cultural activities, sports, public transport, or promotional publications for the city, region, or country (Bonsón & Bednárová, 2018; Bonsón et al., 2015; Hofmann et al., 2013). Nevertheless, Hofmann et al. (2013) argue that there is no particular content type that would guarantee success in terms of higher citizen participation. Our last research question therefore was:

RQ5: Does content type influence citizen engagement?

1.3. METHODOLOGY

1.3.1. Sampling and Data Collection

The sample for this study is taken from the statistics published yearly by the *Instituto de Estadística y Cartografía de Andalucía* (IECA), which includes data for the 29 largest Andalusian municipalities ranked by number of citizens. These municipalities include those with a population exceeding 50,000 inhabitants and together they represent more than half of the Andalusian population. The Twitter account of each municipality was collected by following the icon link on the municipality's official website or by searching the Twitter platform to identify the verified municipality account.

For the 29 municipalities, 28 verified Twitter accounts were identified. The data collection took place in June 2018 using Twint, a Python library for advanced Twitter scraping, which automated the collection process (Zacharias & Poldi, 2018). The 28 verified Twitter accounts of the municipalities, together with all their published tweets that we had scraped together served as inputs for the analysis of the first three research questions (RQ1, RQ2, RQ3), while for the last two research questions (RQ4, RQ5) only the tweets (regardless the twitter account they belong to) that we had scraped together were considered.

The total number of tweets posted by each municipality on its official Twitter account was used to measure activity. The audience of the Twitter account was measured by the number of followers. An adaptation of the Facebook metrics proposed by Bonsón and Ratkai (2013) was used to measure citizen engagement, as shown in Table 1.1.

Metrics	Code	Calculation
Popularity	P1	Number of tweets favorited / total tweets
	P2	Total number of times favorited / total tweets
	P3	(P2 / number of followers) * 1000
Commitment	C1	Number of tweets commented / total tweets
	C2	Total number of comments / total tweets
	C3	(C2 / number of followers) *1000
Virality	V1	Number of tweets retweeted / total tweets
	V2	Total number of retweets / total tweets
	V3	(V2 / number of followers) *1000
Engagement		P3 + C3 + V3

Table 1.1. Metrics for citizens' engagement (Bonsón y Ratkai, 2013)

After using the Python software (Van Rossum, 1995) to scrape the tweets, the R software (R Core Team, 2018) was used to analyse them. Afterwards, a mixed analysis was applied, where quantitative and qualitative data were addressed. The quantitative data were the metrics related to the followers (retweets, replies, likes) that were studied through a statistical analysis to understand the level of citizens' engagement. The qualitative data were analysed through text mining to identify the content of the tweet and the media type.

1.3.2. Content Analysis

This paper also tries to identify whether content category and media type lead to higher citizen engagement (RQ4 and RQ5). The use of media types on Twitter was classified

and coded according to five categories: web links (1), text (2), photo/video (3), photo/video-web links (4), and other (5). The media types were identified by analysing the text of the tweets. If the term "https: //" appears, it contains a web link, to know if it is photo/video the tweet must contain the term "pic.twitter", the other type refers to emojis, which is the term "< Emoji: "and when none of these terms appears, the tweet is a plain text. Table 1.2 shows the content types that were identified and coded to conduct the tweet content analysis.

Content type	Tweet content	Code
Cultural and Marketing	Cultural activities and events, traditional holidays, city promotion, tourism	1
Transport and Public works	Public and private transport, works in the city, town planning	2
Security and Health	Citizen protection and security, health service	3
Employment and Education	Employment and training schemes, education	4
Sport	Sporting activities and events	5
Environment	Environmental concern, public cleaning service	6
Others		7

Table 1.2. Content Types

In the literature, content analysis is defined as a multipurpose research method to investigate a broad spectrum of problems by systematically and objectively identifying the special characteristics of messages (Holsti, 1969). It is useful for large samples, since this analysis compares the content in a systematic, complex, and objective way. Several previous papers on SM communication(Bonsón & Bednárová, 2018; Martí, Royo, & Acerete, 2012; Torres & Pina, 2001) have therefore applied content analysis in their studies.

The process of content analysis has been studied by several authors (Bengtsson, 2016; Erlingsson & Brysiewicz, 2017; Kohlbacher, 2006; Neuman, 2014). Bonsón et al., (2016) refined that process in four steps: (1) sampling, (2) coding, (3) analysing the content, and (4) consolidating the results. The whole process of content analysis that we conducted in this study is depicted in Figure 1.1.

Sampling: The tweets were scraped together at the beginning of June 2018 using Twint.

In total, we analyzed 345,960 tweets, which represented more than 85% of the total of tweets published by the studied municipalities since they joined Twitter until 31th May 2018. The remaining 15% were the retweets, which could not been automatically collected as Twint is not able to scrape together the retweets in a massive way like the common tweets.

Coding: Before coding began, the operative categories for the content of the tweets were identified and defined. The identification of content type was based on the lists of local services prepared by Torres and Pina (2001) and later adapted by several authors (Bonsón et al., 2015; Martí et al., 2012). Even so, we have further refined that list according to the most frequent words published in the tweets provided by local governments. To do so, the R library "tm" (Feinerer, Hornik, & Meyer, 2017) were used. The tm package is a text-mining framework which provides some powerful functions which aids in text-processing steps. The main structure for managing documents in tm is a so-called corpus, representing a collection of text documents. For inspecting and transformation of a corpus, we use various functions (Figure 1.1), such as stop-word removal, stemming, whitespace removal, and so on, we can use the *stopwords("spanish"), content_transformer*, *tolower*, *tm_map* functions and various quantitative functions for text analysis, such as *DocumentTermMatrix*, *findFreqTerms*, *findAssocs*, and *removeSparseTerms* (Varangaonkar, 2017). Frequent words identifying content type were tabulated, mutually compared, discussed, and adjusted if necessary. Through this initial process, the categories were identified and defined as shown in Table 1.2. In addition, through the most frequent words, a dictionary has been created for each category (Figure 1.1), where the words that identify each type of content were found. The creation of the dictionaries has been done with the function of the base package of R, *grepl* (R Core Team, 2018). During this stage, it was possible to identify the areas of confusion and any necessary changes were made in the classification descriptions and the tabulation of frequent words to reduce the overlap error in the tweets. Performing this content classification automatically reduces subjectivity but implies that there are tweets that share more than one category, thus giving an overlap error. These changes were incorporated into the content analysis framework, and the final coding was established.

Figure 1.1. Flowchart of scraping and content analysis
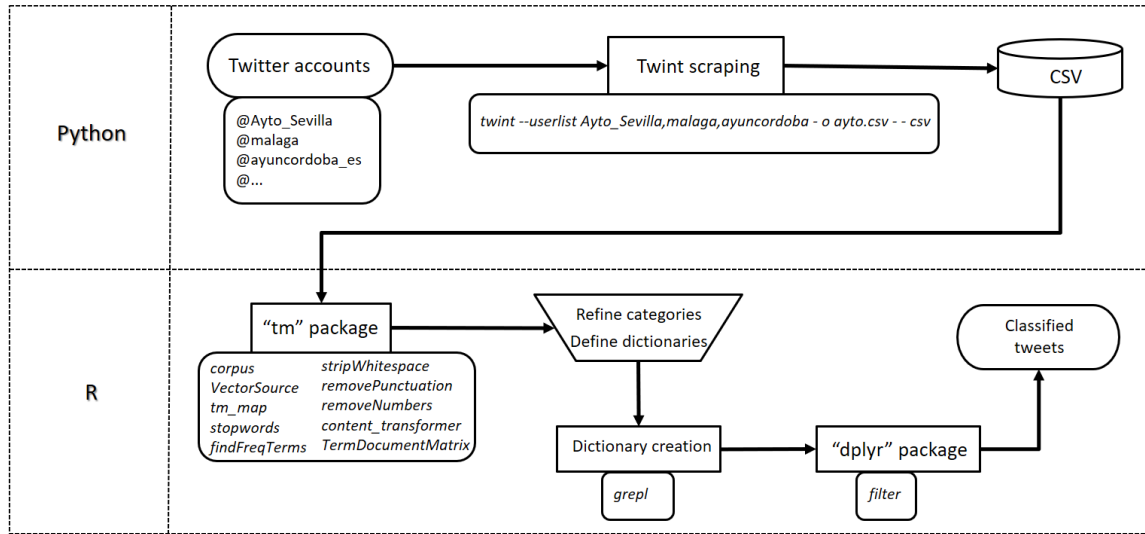
Analysing the content: After establishing the coding, all the tweets were analysed and classified automatically (Figure 1.1) using the R library "dplyr" (Wickham, Francois, Henry, & Muller, 2017). The dplyr is a powerful R-package to transform and summarize tabular data with rows and columns. It is very useful when performing exploratory data analysis and manipulation. The package contains a set of functions that perform common data manipulation operations such as filtering for rows, selecting specific columns, re-ordering rows, adding new columns and summarizing data (Irizarry & Love, 2017). To classify the tweets according to their category the *filter* function was used.

Consolidating the results: Ultimately, the results obtained throughout the content analysis were then consolidated and the statistical differences were assessed.

1.4. RESULTS DESCRIPTIVE STATISTICS

Of the 28 largest municipalities were listed in IECA in 2017, 96.55% of them (28/29) use Twitter as a channel of communication. The maximum number of tweets, belonging to the most active Twitter account, was found to be 109,737, and the minimum was 1,457 tweets. The account with the largest audience had 149,040 followers, and the account with the smallest audience had just 1,500. There are clearly substantial differences among municipalities' corporate Twitter accounts regarding both the number of total tweets and the audience due to the high standard deviations for both variables (Table 1.3).

	Maximum	Average	Minimum	Std. Deviation
Audience	149,040	16,746	1,500	36,430
Activity	109,737	14,531	1,457	20,362

Table 1.3. Number of followers and tweets

The most popular content types among the municipalities in our sample are shown in Table 1.4. The results show that municipalities tend to use their Twitter account as another cultural and city promotion (marketing) tool, as 26.37% of the tweets fall under this category. The second category (25.42%), covers a diversity of topics that are not included in the other categories described. Other categories above 10% are: Transport and public works (16.11%), security and health (12.63%), and employment and education (11.32%).

Content type	Percentage
Cultural and Marketing	26.37%
Others	25.42%
Transport and Public works	16.11%
Security and Health	12.63%
Employment and Education	11.32%
Sport	4.14%
Environment	4.01%

Table 1.4. Percentage of content types

Table 1.5 shows that the most frequently used media type was the website link (35.68%). After website links, the analysis found that municipalities still tend to stick to traditional plain text (28.63%) to communicate with their citizens, rather than employing other visual tools, like photos or videos (16.04%), or the combination of website links and visual tools (13.79%) or other media types with emojis (5.86%).

Media type	Percentage
Web links	35.68%
Text	28.63%
Photo/Video	16.04%
Web links - Photo/Video	13.79%
Others	5.86%

Table 1.5. Percentage of media types

To examine citizen engagement, the metrics proposed by Bonsón and Ratkai (2013) were adopted. The results are provided in Table 1.6. On average, 38% of the tweets were favourited (P1), 10% (C1) were replied to, and 47% were retweeted (V1) by citizens. The average number of favourited tweets (P2) and retweets (V2) were quite high, 1.67 and 1.9, respectively. The average number of replies per tweet was low 0.16 (C2), however. Dividing these by the number of fans and multiplying it by 1000, following the methodology of Bonsón and Ratkai (2013), we obtained the average number of favourites/replies/retweets per tweet per 1000 fans. This result shows that among these 3 ways to interact with municipalities, citizens tend to choose "retweets" more often than

favourites or replies as a means of engaging with their municipality. By summing P3 (26%), C3 (2%), and V3 (29%), we obtained the average index of citizen engagement (E) of 57%.

	Code	Max.	Average	Min.	Std. deviation
	P1	0.74	0.379	0.15	0.14
Popularity	P2	6.69	1.672	0.19	1.62
	P3	1.26	0.262	0.01	0.28
	C1	0.30	0.105	0.02	0.07
Commitment	C2	0.55	0.160	0.03	0.13
	C3	0.05	0.022	0.00	0.01
	V1	0.72	0.470	0.23	0.14
Virality	V2	5.02	1.906	0.43	1.39
	V3	0.77	0.286	0.01	0.20
Engagement	P3+C3+V3	2.02	0.570	0.026	0.471

Table 1.6. Metrics for stakeholder engagement

1.4.1. Statistical Analysis

We also aimed to identify the factors associated with citizen engagement on this platform. Significant negative relationships with activity and audience were detected as shown in Table 1.7, but no significant relationship with municipality size was found. This means that engagement is not associated with municipality size and that more activity and audience generate less engagement.

Dependent variable	Independent variable	Spearman´s coefficient	Significance	Conclusion
	Activity (number of tweets)	-0.716 **	0.000	Negative relations
Engagement	Population (number of inhabitants)	-0.285	0.142	No confirmed
	Audience (number of follower)	-0.595 **	0.000	Negative relations

** Significant at p<0.01 (2-tailed)

Table 1.7. Relationship between activity, population, audience and
citizen engagement

To better understand the relationship between media type and citizen reactions, we summarise the descriptive statistics in Table 1.8, where it can be seen that citizen engagement varies among different media types. According to the results, photos or video generate more retweets (5.02) and favourites (4.88) than other media types do. On the other hand, municipalities receive more replies from citizens by tweeting plain text (0.35),

which usually leads to an open dialogue in which the municipalities reply to the citizen comments. However, plain text is closely followed by photos/videos and other media types (with emoji; both 0.34) in the generation of replies.

Media Type		Number of Favourites	Number of Replies	Number of Retweets
Web links	*Mean*	0.80	0.13	1.49
	N	99,228	15,671	183,767
	Std. Deviation	2.73	0.52	3.23
Text	*Mean*	0.50	0.35	1.10
	N	49,510	34,586	108,482
	Std. Deviation	2.80	0.88	6.38
Photo/Video	*Mean*	4.88	0.34	5.02
	N	270,892	19,001	278,650
	Std. Deviation	16.13	1.26	15.17
Web links - Photo/Video	*Mean*	2.63	0.21	2.81
	N	125,265	9,794	134,141
	Std. Deviation	5.50	0.77	5.44
Others	*Mean*	4.73	0.34	3.84
	N	95,834	6,911	77,779
	Std. Deviation	14.54	1.29	11.53
Total	*Mean*	1.85	0.85	2.26
	N	640,729	85,963	782,819
	Std. Deviation	8.13	8.73	8.13

Table 1.8. Descriptive statistics of media type and citizens' engagement

To confirm that there is a significant relationship between media type and citizens' engagement, Welch's ANOVA test was applied. The results presented in Table 1.9 show that there is a significant relationship between engagement and media type, so using a particular media type leads to increased engagement (measured by favourites, replies, and retweets). We found that photos or videos lead to higher levels of engagement than other media types.

Dependent variables	Independent variable	Method	Significance
Favourites		Welch's ANOVA	0.00
Replies	Media Type	Welch's ANOVA	0.00
Retweets		Welch's ANOVA	0.00

Table 1.9. Welch´s ANOVA test of media type and citizens' engagement. Relationship between the media type and citizens engagement (measured by number of retweets, replies, and favourites)

We also analysed whether different content generated different levels of engagement and whether there was a significant relationship between them.

Table 1.10 shows that each tweet generated an average of 14.17 retweets, 2.03 replies, and 12.03 favourites. As discussed above, citizens tend to engage with municipalities by using the retweet function as it offers a fast way to express their thoughts about or agreement with the published content. Our study also shows that: (1) sport is the content that generates more retweets (2.91), (2) citizens tend to reply more to environmental concerns (0.52), and (3) cultural and city promotion content generates more favourites (2.47) than any other content.

Content Type		Number of Favourites	Number of Replies	Number of Retweets
Cultural and Marketing	*Mean*	2.47	0.20	2.88
	N	273,771	21,676	318,693
	Std. Deviation	11.04	0.93	10.15
Others	*Mean*	1.96	0.23	2.51
	N	209,695	24,631	268,511
	Std. Deviation	6.88	0.83	7.67
Transport and Public works	*Mean*	0.75	0.34	0.97
	N	51,087	22,937	65,759
	Std. Deviation	4.12	0.74	3.87
Security and Health	*Mean*	0.99	0.35	1.22
	N	52,625	18,416	64,612
	Std. Deviation	6.52	0.76	7.64
Employment and Education	*Mean*	1.58	0.19	1.93
	N	75,062	9,018	91,854
	Std. Deviation	4.16	0.78	5.81
Sport	*Mean*	2.50	0.21	2.91
	N	43,566	3,648	50,592
	Std. Deviation	9.15	0.89	7.13
Environment	*Mean*	1.77	0.52	1.76
	N	29,832	8,710	29,669
	Std. Deviation	4.95	1.31	4.45
Total	*Mean*	1.75	0.26	2.12
	N	735.638	109.036	889,690
	Std. Deviation	7,69	0.86	7.69

Table 1.10. Descriptive statistics of content type and citizens' engagement

As shown in Table 1.11, Welch's ANOVA was again applied to identify whether there is a significant relationship between content type and citizen engagement. The results confirm that different content types influence citizen engagement (measured by favourites, replies, and retweets). We found that sport, followed very closely by culture and city promotion, lead to higher citizen engagement than other content types.

Dependent variables	Independent variable	Method	Significance
Favourites		Welch's ANOVA	0.00
Replies	Content category	Welch's ANOVA	0.00
Retweets		Welch's ANOVA	0.00

Table 1.11. Welch´s ANOVA test of content category and citizens' engagement. Relationship between the content and citizens' engagement (measured by number of retweets, replies, and favourites)

1.4.2. Multivariate Statistics

To confirm the results of the Welch's ANOVA tests suggesting that media and content types are associated with citizen engagement, multivariate statistics applying the generalised linear model (GLM) were obtained. A GLM is a flexible generalisation of an ordinary linear regression that allows for response variables that do not have a normal distribution. It was therefore appropriate for our sample as the distributions of the dependent variables representing the citizen engagement (favourites, replies, and retweets) were non-normal. A negative binomial regression was applied, since it can be used for over-dispersed count data (when the conditional variance exceeds the conditional mean). It can be considered a generalisation of Poisson regression, because it has the same mean structure as Poisson regression and it has an extra parameter to model the over-dispersion. The research questions were tested at the multivariate level with two independent variables: media type and content type. The results of the statistical analysis are shown in Table 1.12.

Independent variable	Dependent variable								
	Favourites			Replies			Retweets		
	Resid. Dev	df	Sig.	Resid. Dev	df	Sig.	Resid. Dev	df	Sig.
(Intercept)	473465	1	0.00 **	245828	1	0.00 **	454388	1	0.00 **
Media type	354536	4	0.00 **	233644	4	0.00 **	397268	4	0.00 **
Content type	349814	6	0.00 **	230546	6	0.00 **	386194	6	0.00 **

** Significant at $p<0.01$ (2-tailed)

Table 1.12. Multivariate statistics – Generalised Linear Model

The findings of the GLM confirm the assumption that particular content and media types can generate higher citizen engagement. More specifically, photos and videos are the most engaging media types, while topics related to sports are the most engaging content types.

1.5. DISCUSSION

Our findings show that 96.55% (28/29) of the largest Andalusian municipalities have an official Twitter account. Nevertheless, the accounts differ in terms of their activity (measured by the number of tweets) and audience (measured by the number of followers).

The most common tweet content type appeared to be cultural and marketing content (26.37%). Similar to other social media, Twitter enables promotion of the city for a relatively low or even zero cost compared to other means of advertising. Thus, municipalities actively incorporate Twitter into their online communication strategy and publish many promotional tweets.

Regarding media type, our findings show that website links (35.68%) were the most frequently used. This may be due to Twitter's character limitation, which only allows tweets of up to 280 characters to be published. Municipalities therefore post tweets with a link to the website and direct citizens to the web page containing the target information, such as a webpage concerning an event, a job offer, or sports activity registration and so on.

Another finding that emerged from this study is that among the 3 ways to interact with municipalities on Twitter (favourite, reply, and retweet), citizens tend to choose retweets more often than favourites or replies to interact with the municipality. A possible explanation might be the simplicity of clicking the retweet button, which is remarkably convenient for citizens and enables them to express their opinions quickly without writing a comment. Compared to making a reply, retweets are done in less time. It is much more comfortable. The retweet button also offers greater visibility than the favourite button, as the content is visible on the wall of the citizen to all his or her followers.

We also aimed to answer five research questions related to Twitter activity and citizen engagement on this platform. First, whereas the previous research analysing Western European municipalities outlined that bigger municipalities tended to have better developed online communication strategies and therefore were more active on SM than smaller municipalities (Bonsón et al., 2017), in our study, no significant relationship was found between municipality size and Twitter activity. Being a large municipality does not necessarily lead to a more active presence on Twitter.

We also examined which factors influenced citizen engagement on Twitter by applying

the metrics proposed by Bonsón and Ratkai (2013). A significant negative relationship was found between Twitter activity (measured by the number of published tweets), the audience (measured by the number of followers), and the citizen engagement. This finding is in accord with previous research (Bonsón et al., 2017; Ma, 2013) reporting similar results. Ma (2013) argues that this might be due to a feeling of closeness or that one's voice matters in smaller communities, which encourages a user to participate in conversations more actively.

We have also identified which media and content types generate greater citizen engagement (considering the number of favourites, replies, and retweets). Our findings show that photos and videos generate the highest rates of favourites and retweets. These results are in accord with previous studies (Bonsón et al., 2015; Hofmann et al., 2013; Zavattaro et al., 2015) and the literature on media richness (Phillips et al., 2009; Davison, 2007; Graves et al., 1996). Photos and videos transmit information in a quick and visual way that generates more interaction (favourites or retweets) compared to other types of media. The media type that generates the highest response rate and helps to initiate a dialogue in the form of replies was, however, plain text.

In terms of which content type generates higher citizen engagement, we found that sport content generated the most retweets and favourites, followed very closely by cultural and city promotional content. While the content that tended to receive the most replies was related to environmental issues, followed by transport and public works, and security and health topics. Hofmann et al. (2013) argue that there is no topic that guarantees success in terms of citizen engagement. Nevertheless, our findings about sport and cultural and city promotional content are in accord with previous research (Bonsón & Bednárová, 2018; Bonsón et al., 2015). A possible explanation of the popularity of a city promotional content is perhaps also the fact that Andalusia is a popular destinations to visit in Spain (INE, 2018).

1.5.1. Contribution to theory

This study brings some evidence on the factors that influence the citizen's engagement on Twitter. Thus, the findings might be used to build a Twitter commitment model for the municipalities to explain the relationship between the antecedent factors, the commitment that occurs, and the attitudinal and behavioural effects on the users. This model could be based on the social media citizens engagement model proposed by Grover

and Kar (2018). Additionally, we provide a new methodology to massively scrape and analyse a large amount of twitter data.

1.5.2. Implications for practice

The findings of our study may have practical implications for public-sector community managers responsible for online communication. Thus, insights from our study might help local governments to improve their online communication strategy by revealing factors that lead to higher citizens` responsiveness. Potentially interesting might be the findings that different content and media types generate different levels of citizen engagement and that small Twitter account size (activity and audience) is not a limitation—indeed, smaller-sized Twitter accounts tend to have more engaged followers. Being able to maintain a fluid dialogue with citizens by addressing their needs, the quality of public services offered might be improved as well.

1.6. CONCLUSIONS

To the best our knowledge, this is the first study exploring municipality communication and citizen's engagement via Twitter through analysis of almost all the tweets from the largest Andalusian municipalities. This study provided an initial assessment of such practices and sought to answer the following questions: (1) To what extent do municipalities use Twitter as a communication channel to engage with their citizens? (2) What factors influence citizen engagement on Twitter?

The results show that most of the local governments in Andalusia have an official corporate Twitter account with different levels of activity and audience. Content related to cultural activities and city promotion are the most frequently twitted.

Regarding the citizen engagement, retweets are the most frequent way for citizens to interact with the city council account. Engagement seems not to be related to the population of the municipality, yet there is a significant negative relationship with respect to the audience and the activity. The findings of the study also show that photos and videos generate more engagement (retweets and favourites) than other media types. The same happens to content types where those tweets related to sports (retweet and favourites) and environmental issues (replies) generate the highest engagement.

In a nutshell, it can be concluded that both activity and audience of the twitter account have a negative influence on engagement while media and content types affect it

positively.

1.7. LIMITATIONS AND FUTURE RESEARCH

Before closing, a number of limitations—together with recommendations for future research—have to be acknowledged. The first limitation is about the sample. 28 accounts do not generalize the results. For that reason, it should be extended to a higher sample in the following researches.

According, the limitation about the statistical tests. As our data did not have a normal distribution, nonparametric alternatives were adopted, such as Spearman, Welch's ANOVA, and the GLM, which are inherently less accurate than their parametric alternatives.

Another limitation stems from the automated content analysis, which classified the tweets using a dictionary of the most frequent words. This approach eliminates subjectivity, but classification is exposed to an error if there are tweets that share more than one category. Future research might therefore try to design a more accurate technique to reduce this limitation.

There is also a limitation while analysing media types, since both photos and videos were assigned to the same group. An automated method able to distinguish photos from videos would give more accurate insights.

Another limitation that should be acknowledged is related to retweets, replies and favourites which are considered proxies for citizens` engagement but they might actually have different contextual usage. Hence, more in depth analysis might be applied in the future studies to reduce this bias. According to Duguay (2016), the tweets with hashtags are much more visible throughout the online network. Hence, a hashtag and its effect on the citizens commitment might be another interesting element worth exploring (Grover, Kar, & Davies, 2018).

Although this empirical research was carried out at the local government level in Andalusia, its main contribution can be extrapolated to other Spanish regions such as Catalonia, Valencia, or Castilla y Leon, which apparently have similar rates of Twitter users (Delgado von Eitzen, 2016; The Social Media Family, 2018). However, future studies could adopt our approach and apply it to a comparative context with other national

and international regions, which could improve the generalisability and understanding of the results.

It could also be of great interest to conduct research exploring the reasons leading users to interact with municipalities' Twitter pages. The collected evidence could thus contribute to develop a Twitter commitment model for the municipalities to explain the relationship between the antecedent factors, the commitment that occurs, and the attitudinal and behavioural effects on the users.

REFERENCES

Abdelsalam, H. M., Reddick, C. G., Gamal, S., & Al-shaar, A. (2013). Social media in Egyptian government websites: Presence, usage, and effectiveness. *Government Information Quarterly*, *30*(4), 406–416. https://doi.org/10.1016/J.GIQ.2013.05.020

Agostino, D. (2013). Using social media to engage citizens: A study of Italian municipalities. *Public Relations Review*, *39*(3), 232–234. https://doi.org/10.1016/J.PUBREV.2013.02.009

Alexa. (2018). Twitter.com Traffic Statistics. Retrieved June 6, 2018, from https://www.alexa.com/siteinfo/twitter.com

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, *2*, 8–14. https://doi.org/10.1016/J.NPLS.2016.01.001

Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, *27*(3), 264–271. https://doi.org/10.1016/J.GIQ.2010.03.001

Bertot, J. C., Jaeger, P. T., Munson, S., & Glaisyer, T. (2010). Social Media Technology and Government Transparency. *Computer*, *43*(11), 53–59. https://doi.org/10.1109/MC.2010.325

Bonsón, E., & Bednárová, M. (2018). The use of YouTube in western European municipalities. *Government Information Quarterly*, *35*(2), 223–232. https://doi.org/10.1016/J.GIQ.2018.04.001

Bonsón, E., Bednarova, M., & Escobar-Rodríguez, T. (2014). Corporate YouTube practices of Eurozone companies. *Online Information Review*, *38*(4), 484–501. https://doi.org/10.1108/OIR-07-2013-0181

Bonsón, E., Bednárová, M., & Wei, S. (2016). Corporate Twitter use and stakeholder engagement: An empirical analysis of the Spanish hotel industry. Retrieved from https://search.proquest.com/openview/f903aaf5c9c836290e8471d27f20cd01/1?pq-origsite=gscholar&cbl=55001

Bonsón, E., & Ratkai, M. (2013). A set of metrics to assess stakeholder engagement and social legitimacy on a corporate Facebook page. *Online Information Review*, *37*(5), 787–803. https://doi.org/10.1108/OIR-03-2012-0054

Bonsón, E., Royo, S., & Ratkai, M. (2015). Citizens' engagement on local governments' Facebook sites. An empirical analysis: The impact of different media and content types in Western Europe. *Government Information Quarterly*, *32*(1), 52–62. https://doi.org/10.1016/J.GIQ.2014.11.001

Bonsón, E., Royo, S., & Ratkai, M. (2017). Facebook Practices in Western European Municipalities. *Administration & Society*, *49*(3), 320–347. https://doi.org/10.1177/0095399714544945

Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, *29*(2), 123–132. https://doi.org/10.1016/J.GIQ.2011.10.001

Bovaird, T. (2017). Improving Public Services Through E-Government and Citizen

Engagement: Comparing Emerging Lessons in East and West European Countries. In *Improving the Quality of East and West European Public Services* (pp. 252–256). Routledge. https://doi.org/10.4324/9781351155922-20

Carpini, M. X. D., Cook, F. L., & Jacobs, L. R. (2004). Public deliberation, discursive participation, and citizen engagement: A Review of the Empirical Literature. *Annual Review of Political Science*, *7*(1), 315–344. https://doi.org/10.1146/annurev.polisci.7.121003.091630

Chen, L., Wang, W., & Sheth, A. P. (2012). Are Twitter Users Equal in Predicting Elections? A Study of User Groups in Predicting 2012 U.S. Republican Presidential Primaries (pp. 379–392). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-35386-4_28

Chun, S. A., Shulman, S., Sandoval, R., & Hovy, E. (2010). Government 2.0: Making connections between citizens, data and government. *Information Polity*, *15*(1,2), 1–9. Retrieved from https://dl.acm.org/citation.cfm?id=1858986

Criado, J. I., Martínez-Fuentes, G., & Silván, A. (2012). Social Media for Political Campaigning. The Use of Twitter by Spanish Mayors in 2011 Local Elections. In *Web 2.0 Technologies and Democratic Governance* (pp. 219–232). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4614-1448-3_14

Criado, J. I., Sandoval-Almazan, R., & Gil-Garcia, J. R. (2013). Government innovation through social media. *Government Information Quarterly*, *30*(4), 319–326. https://doi.org/10.1016/J.GIQ.2013.10.003

Davison, J. (2007). Photographs and accountability: cracking the codes of an NGO. *Accounting, Auditing & Accountability Journal*, *20*(1), 133–158. https://doi.org/10.1108/09513570710731236

Delgado von Eitzen, C. (2016). Perfil del usuario de Twitter en España en 2016. Retrieved July 27, 2018, from http://www.christiandve.com/2016/10/perfil-usuario-twitter-espana-resultados/

Ekman, J., & Amnå, E. (2012). Political participation and civic engagement: Towards a new typology. *Human Affairs*, *22*(3). https://doi.org/10.2478/s13374-012-0024-1

Ellison, N., & Hardey, M. (2014). Social Media and Local Government: Citizenship, Consumption and Democracy. *Local Government Studies*, *40*(1), 21–40. https://doi.org/10.1080/03003930.2013.799066

Eltantawy, N., & Wiest, J. B. (2011). *Social Media in the Egyptian Revolution: Reconsidering Resource Mobilization Theory*. *International Journal of Communication* (Vol. 5). Retrieved from http://ijoc.org.

Erlingsson, C., & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African Journal of Emergency Medicine*, *7*(3), 93–99. https://doi.org/10.1016/J.AFJEM.2017.08.001

European Commission. (2018). *Índice de la Economía y la Sociedad Digitales (DESI) 1 2018, Informe de país para España*. Retrieved from https://ec.europa.eu/digital-

Feinerer, I., Hornik, K., & Meyer, D. (2017). Text Mining Infrastructure in R. *Journal of Statistical Software*, *25*(5), 1–54. Retrieved from https://cran.r-project.org/package=tm

Feroz Khan, G., Young Yoon, H., Kim, J., & Woo Park, H. (2014). From e-government to

social government: Twitter use by Korea's central government. *Online Information Review*, *38*(1), 95–113. https://doi.org/10.1108/OIR-09-2012-0162

Franklin, A. L., & Ebdon, C. (2002). Citizen Participation: Looks Good on Paper but Hard To Do in Practice. *Journal of Public Administration*, *24*(4), 385–403. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/aspa/unpan005971.pdf

Freeman, R. E. (1984). *Strategic management : a stakeholder approach*. Retrieved from https://books.google.es/books?hl=es&lr=&id=NpmA_qEiOpkC&oi=fnd&pg=PR5&dq=St rategic+Management:+A+Stakeholder+Approach&ots=60emL7PaUO&sig=PD8MM3d0j bs2SHDzYTFe2Fmwu_U#v=onepage&q=Strategic Management%3A A Stakeholder Approach&f=false

Fundación Orange. (2014). *eEspaña 2014*. https://doi.org/ISSN 2174-3886

Fundación Telefónica. (2016). *La Sociedad de la Información en España 2015*. https://doi.org/ISBN: 978-84-08-15279-8

Gil de Zúñiga, H., Jung, N., & Valenzuela, S. (2012). Social Media Use for News and Individuals' Social Capital, Civic Engagement and Political Participation. *Journal of Computer-Mediated Communication*, *17*(3), 319–336. https://doi.org/10.1111/j.1083-6101.2012.01574.x

Graham, M., & Avery, E. J. (2013). Government Public Relations and Social Media: An Analysis of the Perceptions and Trends of Social Media Use at the Local Government Level. *Public Relations Journal*, *7*(4). Retrieved from https://prjournal.instituteforpr.org/wp-content/uploads/2013GrahamAvery.pdf

Graves, O. F., Flesher, D. L., & Jordan, R. E. (1996). Pictures and the bottom line: The television epistemology of U.S. annual reports. *Accounting, Organizations and Society*, *21*(1), 57–88. https://doi.org/10.1016/0361-3682(94)00026-R

Grover, P., & Kar, A. K. (2018). User engagement for mobile payment service providers – introducing the social media engagement model. *Journal of Retailing and Consumer Services*. https://doi.org/10.1016/J.JRETCONSER.2018.12.002

Grover, P., Kar, A. K., & Davies, G. (2018). "Technology enabled Health" – Insights from twitter analytics with a socio-technical perspective. *International Journal of Information Management*, *43*, 85–97. https://doi.org/10.1016/J.IJINFOMGT.2018.07.003

Grover, P., Kar, A. K., Dwivedi, Y. K., & Janssen, M. (2018). Polarization and acculturation in US Election 2016 outcomes – Can twitter analytics predict changes in voting preferences. *Technological Forecasting and Social Change*. https://doi.org/10.1016/J.TECHFORE.2018.09.009

Guillamón, M.-D., Ríos, A.-M., Gesuele, B., & Metallo, C. (2016). Factors influencing social media use in local governments: The case of Italy and Spain. *Government Information Quarterly*, *33*(3), 460–471. https://doi.org/10.1016/J.GIQ.2016.06.005

Halpern, D., & Katz, J. E. (2012). From e-government to social network government. In *Proceedings of the 3rd Annual ACM Web Science Conference on - WebSci '12* (pp. 119–127). New York, New York, USA: ACM Press. https://doi.org/10.1145/2380718.2380735

Haro-De-Rosario, A., Sáez-Martín, A., & Caba-Pérez, M. del C. (2018). Using social media to enhance citizen engagement with local government: Twitter or Facebook? *Sage*, *20*(1), 29–49. https://doi.org/10.1177/1461444816645652

Hernández Sampieri, R., Fernández Collado, C., & Baptista Lucio, M. del P. (2010). *Metodología de la investigación*. (The McGraw-Hill, Ed.) (5th ed.). Mexico. Retrieved from www.FreeLibros.com

Hofmann, S., Beverungen, D., Räckers, M., & Becker, J. (2013). What makes local governments' online communications successful? Insights from a multi-method analysis of Facebook. *Government Information Quarterly*, *30*(4), 387–396. https://doi.org/10.1016/J.GIQ.2013.05.013

Holsti, O. R. (1969). *Content analysis for the social sciences and humanities*. Reading Mass.: Addison-Wesley Pub. Co. Retrieved from http://www.worldcat.org/title/content-analysis-for-the-social-sciences-and-humanities/oclc/45548

Honeycutt, C., & Herring, S. C. (2009). Beyond Microblogging: Conversation and Collaboration via Twitter. Retrieved from http://bitlib.org/twitter/index.php

IECA, I. de E. y C. de A. (2017). Padrón Municipal de Habitantes. Cifras oficiales de población municipal. Retrieved July 18, 2018, from https://www.juntadeandalucia.es/institutodeestadisticaycartografia/badea/informe/anual?CodOper=b3_128&idNode=7488

INE, I. N. de E. (2017). Estadísticas territoriales. Retrieved June 8, 2018, from http://www.ine.es/FichasWeb/Welcome.do

INE, I. N. de E. (2018). Número de turistas según comunidad autónoma de destino principal. Retrieved July 19, 2018, from http://www.ine.es/jaxiT3/Tabla.htm?t=10823

Irizarry, R., & Love, M. (2017). dplyr tutorial. Retrieved December 26, 2018, from http://genomicsclass.github.io/book/pages/dplyr_tutorial.html

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Junta de Castilla y León. (2012). *Guía práctica para el uso de redes sociales en los ayuntamientos*. Retrieved from https://telecentros.burgos.es/sites/default/files/file/page/Gua Redes Sociales para Ayuntamientos.pdf

Kahne, J., & Bowyer, B. (2018). The Political Significance of Social Media Activity and Social Networks. *Political Communication*, *35*(3), 470–493. https://doi.org/10.1080/10584609.2018.1426662

Kavanaugh, A. L., Fox, E. A., Sheetz, S. D., Yang, S., Li, L. T., Shoemaker, D. J., … Xie, L. (2012). Social media use by government: From the routine to the critical. *Government Information Quarterly*, *29*(4), 480–491. https://doi.org/10.1016/J.GIQ.2012.06.002

Kent, M. L., & Taylor, M. (1998). Building dialogic relationships through the world wide web. *Public Relations Review*, *24*(3), 321–334. https://doi.org/10.1016/S0363-8111(99)80143-X

Kent, M. L., & Taylor, M. (2002). Toward a dialogic theory of public relations. *Public Relations Review*, *28*(1), 21–37. https://doi.org/10.1016/S0363-8111(02)00108-X

Kim, D., Chun, H., Kwak, Y., & Nam, Y. (2014). The Employment of Dialogic Principles in Website, Facebook, and Twitter Platforms of Environmental Nonprofit Organizations.

Social Science Computer Review, *32*(5), 590–605. https://doi.org/10.1177/0894439314525752

Kim, Y., Hsu, S.-H., & de Zúñiga, H. G. (2013). Influence of Social Media Use on Discussion Network Heterogeneity and Civic Engagement: The Moderating Role of Personality Traits. *Journal of Communication*, *63*(3), 498–516. https://doi.org/10.1111/jcom.12034

Kohlbacher, F. (2006). The Use of Qualitative Content Analysis in Case Study Research. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *7*(1). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/75/153

Krishnan, S., Teo, T. S. H., & Lymm, J. (2017). Determinants of electronic participation and electronic government maturity: Insights from cross-country data. *International Journal of Information Management*, *37*(4), 297–312. https://doi.org/10.1016/J.IJINFOMGT.2017.03.002

Lerman, K., & Ghosh, R. (2010). Information Contagion: an Empirical Study of the Spread of News on Digg and Twitter Social Networks. Retrieved from https://networkchallenge.darpa.mil

Ma, L. (2013). The Diffusion of Government Microblogging. *Public Management Review*, *15*(2), 288–309. https://doi.org/10.1080/14719037.2012.691010

Mambrey, P., & Dörr, R. (2011). Local government and social networking technologies in Germany: The example of Twitter. *Proceedings of the International Conference for E-Democracy and Open Government (CeDEM11)*, 249–259. Retrieved from www.jedem.org

Martí, C., Royo, S., & Acerete, B. (2012). The Effect of New Legislation on the Disclosure of Performance Indicators: The Case of Spanish Local Governments. *International Journal of Public Administration*, *35*(13), 873–885. https://doi.org/10.1080/01900692.2012.686032

Mergel, I. (2013). A framework for interpreting social media interactions in the public sector. *Government Information Quarterly*, *30*(4), 327–334. https://doi.org/10.1016/j.giq.2013.05.015

Münchener Kreis, E. (2013). Innovationsfelder der digitalen Welt. *Innovationsfelder Der Digitalen Welt. Bedürfnisse von Übermorgen*. Retrieved from https://www.eict.de/fileadmin/redakteure/Downloads/Zukunftsstudien/2013_Innovationsfelder_der_digitalen_Welt.pdf

Nabatchi, T., & Amsler, L. B. (2014). Direct Public Engagement in Local Government. *The American Review of Public Administration*, *44*(4_suppl), 63S–88S. https://doi.org/10.1177/0275074013519702

Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches. Seventh Edition*. Retrieved from www.pearsoned.co.uk

Norris, D. F., & Reddick, C. G. (2013). Local E-Government in the United States: Transformation or Incremental Change? *Public Administration Review*, *73*(1), 165–175. https://doi.org/10.1111/j.1540-6210.2012.02647.x

Oliveira, G. H. M., & Welch, E. W. (2013). Social media use in local government: Linkage of technology, task, and organizational context. *Government Information Quarterly*, *30*(4), 397–405. https://doi.org/10.1016/J.GIQ.2013.05.019

Panagiotopoulos, P., Bigdeli, A. Z., & Sams, S. (2014). Citizen–government collaboration on

social media: The case of Twitter in the 2011 riots in England. *Government Information Quarterly*, *31*(3), 349–357. https://doi.org/10.1016/J.GIQ.2013.10.014

Phillips, J., Hageman, A. M., Cho, C. H., Phillips, J. R., & Patten, D. M. (2009). Media richness, user trust, and perceptions of corporate social responsibility An experimental investigation of visual web site disclosures Corporate social responsibility 933. *Auditing & Accountability Journal*, *22*(6), pp. https://doi.org/10.1108/09513570910980481

Pole, A., & Xenos, M. (2011). Like, Comments and Retweets: Facebooking and Tweeting on the 2010 Gubernatorial Campaign Trail. *State Politics and Policy Conference*.

R Core Team. (2018). R: A Language and Environment for Statistical Computing. Vienna, Austria. Retrieved from https://www.r-project.org/

ReasonWhy. (2018). Los CEOs españoles, los más comprometidos de Europa con las redes sociales. Retrieved January 8, 2019, from https://www.reasonwhy.es/actualidad/social-media/barometro-redes-sociales-hootsuite-2018

Ríos, A.-M., Benito, B., & Bastida, F. (2017). Factors Explaining Public Participation in the Central Government Budget Process. *Australian Journal of Public Administration*, *76*(1), 48–64. https://doi.org/10.1111/1467-8500.12197

Rowe, G., & Frewer, L. J. (2000). Public Participation Methods: A Framework for Evaluation. *Science, Technology, & Human Values*, *25*(1), 3–29. https://doi.org/10.1177/016224390002500101

Sáez Martín, A., Haro de Rosario, A., & Caba Pérez, M. D. C. (2015). Using Twitter for Dialogic Communication: Local Government Strategies in the European Union. *Local Government Studies*, *41*(3), 421–444. https://doi.org/10.1080/03003930.2014.991866

Sánchez, S. (2018). Estadísticas redes sociales 2018 en España. Retrieved January 8, 2019, from https://www.concepto05.com/2018/07/estadisticas-redes-sociales-2018-en-espana/

Siebers, V., Gradus, R., & Grotens, R. (2018). Citizen engagement and trust: A study among citizen panel members in three Dutch municipalities. *The Social Science Journal*. https://doi.org/10.1016/J.SOSCIJ.2018.09.010

Skoric, M. M., Zhu, Q., Goh, D., & Pang, N. (2016). Social media and citizen engagement: A meta-analytic review. *New Media & Society*, *18*(9), 1817–1839. https://doi.org/10.1177/1461444815616221

Smailovic, J., Kranjc, J., Grcar, M., Znidarsic, M., & Mozetic, I. (2015). Monitoring the Twitter sentiment during the Bulgarian elections. In *2015 IEEE International Conference on Data Science and Advanced Analytics (DSAA)* (pp. 1–10). IEEE. https://doi.org/10.1109/DSAA.2015.7344886

Snead, J. T. (2013). Social media use in the U.S. Executive branch. *Government Information Quarterly*, *30*(1), 56–63. https://doi.org/10.1016/J.GIQ.2012.09.001

Sobaci, M. Z., & Karkin, N. (2013). The use of twitter by mayors in Turkey: Tweets for better public services? *Government Information Quarterly*, *30*(4), 417–425. https://doi.org/10.1016/J.GIQ.2013.05.014

Statistic. (2018). Countries with most Twitter users 2018. Retrieved January 8, 2019, from https://www.statista.com/statistics/242606/number-of-active-twitter-users-in-selected-countries/

Stelzner, M. A. (2018). *Social Media Marketing Industry Report*. Retrieved from https://www.socialmediaexaminer.com/wp-content/uploads/2018/05/Industry-Report-2018.pdf

Suchman, M. C. (1995). Managing Legitimacy: Strategic and Institutional Approaches. *Academy of Management Review*, *20*(3), 571–610. https://doi.org/10.5465/amr.1995.9508080331

Suebvises, P. (2018). Social capital, citizen participation in public administration, and public sector performance in Thailand. *World Development*, *109*, 236–248. https://doi.org/10.1016/J.WORLDDEV.2018.05.007

The Social Media Family. (2018). *IV Estudio sobre los usuarios de Facebook, Twitter e Instagram en España*. Retrieved from http://www.abc.es/gestordocumental/uploads/internacional/Informe_RRSS_2018_The_Social_Media_Family.pdf

Torres, L., & Pina, V. (2001). Publicprivate partnership and private finance initiatives in the EU and Spanish local governments. *European Accounting Review*, *10*(3), 601–619. https://doi.org/10.1080/713764637

Van Rossum, G. (1995). *Python tutorial*. Amsterdam.

Varangaonkar, A. (2017). 9 Useful R Packages for NLP & Text Mining. Retrieved December 26, 2018, from https://hub.packtpub.com/9-useful-r-packages-for-nlp-text-mining/

Warren, A. M., Sulaiman, A., & Jaafar, N. I. (2014). Social media effects on fostering online civic engagement and building citizen trust and trust in institutions. *Government Information Quarterly*, *31*(2), 291–301. https://doi.org/10.1016/J.GIQ.2013.11.007

Waters, R. D., & Lo, K. D. (2012). Social Media Sphere: A Content Analysis of Nonprofit Organizations' Use of Facebook. *Journal of Intercultural Communication Research*, *41*(3), 297–319. https://doi.org/10.1080/17475759.2012.728772

Wattal, S., Schuff, D., Mandviwalla, M., & Williams, C. B. (2010). Web 2.0 and Politics: The 2008 U.S. Presidential Election and an E-Politics Research Agenda. *MIS Quarterly*, *34*(4), 669. https://doi.org/10.2307/25750700

Wickham, H., Francois, R., Henry, L., & Muller, K. (2017). dplyr: A Grammar of Data Manipulation. Retrieved from https://cran.r-project.org/package=dplyr

Zacharias, C., & Poldi, F. (2018). TWINT - Twitter Intelligence Tool. Florida: GitHub. Retrieved from https://github.com/twintproject/twint

Zafiropoulos, K., Antoniadis, K., & Vrana, V. (2014). Sharing Followers in e-Government Twitter Accounts: The Case of Greece. *Future Internet*. https://doi.org/10.3390/fi6020337

Zavattaro, S. M., French, P. E., & Mohanty, S. D. (2015). A sentiment analysis of U.S. local government tweets: The connection between tone and citizen involvement. *Government Information Quarterly*, *32*(3), 333–341. https://doi.org/10.1016/J.GIQ.2015.03.003

Zavattaro, S. M., & Sementelli, A. J. (2014). A critical examination of social media adoption in government: Introducing omnipresence. *Government Information Quarterly*, *31*, 257–264. https://doi.org/10.1016/j.giq.2013.10.007

Zhang, W., Johnson, T. J., Seltzer, T., & Bichard, S. L. (2010). The Revolution Will be Networked. *Social Science Computer Review*, *28*(1), 75–92. https://doi.org/10.1177/0894439309335162

Zheng, L., & Zheng, T. (2014). Innovation through social media in the public sector: Information and interactions. *Government Information Quarterly*, *31*, S106–S117. https://doi.org/10.1016/J.GIQ.2014.01.011

Zukin, C., Keeter, S., Andolina, M., Jenkins, K., & Carpini, M. X. D. (2006). *A New Engagement?: Political Participation, Civic Life, and the Changing American Citizen*. *Oxford University Press*. New York. https://doi.org/10.1111/j.1467-9221.2007.00606.x

CHAPTER 2

Debido a restricciones relativas a derechos de autor, el artículo que forma parte del apartado "Chapter 2" ha sido retirado de la tesis. En sustitución de dicho artículo ofrecemos la siguiente información: referencia bibliográfica, enlace a la revista y resumen.

Perea, D., Bonsón, E., & Bednárová, M. (2021). Citizen reactions to municipalities' Instagram communication. In Government Information Quarterly (p. 101579). Elsevier BV. https://doi.org/10.1016/j.giq.2021.101579

Enlace al texto completo del artículo: https://doi.org/10.1016/j.giq.2021.101579

RESUMEN:

In this paper, we explore how local governments are using Instagram as a communication tool to engage with their citizens, using data from the municipalities of Andalusia (Spain). We seek to identify the determinants of local government use of Instagram, the determinants of activity in this channel and the determinants of citizen reactions in order to understand the influence of media types (picture, video or album) used in municipality posts, and to understand content type (what the post is about). Instaloader, an open source intelligence (OSINT) tool for Instagram, was applied. It made it possible to automatically extract all posts of the analysed municipalities (14,742 posts). These were later automatically analysed using R, an open source software. It was determined that of the 29 Andalusian local governments with the highest populations, only those that maintain an account on Instagram, totalling 17 municipalities (58.62%), would be part of the final analysis. Our findings demonstrate that when local governments have a high level of debt, they do not maintain and actively use Instagram accounts. We also found that quality of posts' content is more important than quantity of followers, since there is no significant relationship between citizen reactions and the number of inhabitants of a municipality or the number of followers (audience), while there is a significant negative relationship between the number of posts (activity) and reactions. Our results also highlight that the level of reactions can be stimulated by certain media and content types.

CHAPTER 3

ENVIRONMENTAL DISCLOSURE AS A TOOL FOR PUBLIC SECTOR LEGITIMACY: A TWITTER INTELLIGENCE APPROACH.

Abstract

The purpose of this study is to measure the extent of Twitter environmental reporting by Andalusian municipalities (Spain) and identify the determinant factors of such a disclosure. Thus, factors such as population, geolocation, political signs and sustainable commitments were analyzed under the legitimacy theory approach.

The sample consisted of the official Twitter accounts of the 153 biggest local governments in Andalusia. The classification of the environmental tweets was based on a dictionary based on the GRI reporting standards for environmental disclosure, and a Twitter Environmental Disclosure Index (TEDI) was developed.

The results show that most of the local governments in Andalusia (77.78%) have an official Twitter account with different levels of audience, penetration and activity. On the other hand, it was found that environmental disclosure is very low. However, municipalities with more surplus budget and especially municipalities with a greater number of sustainable commitments networks tend to report more on environmental issues through Twitter.

Keywords government, Twitter, Environmental disclosure, Legitimacy theory, GRI reporting

142

3.1. INTRODUCTION

Air and water pollution, waste disposal, deforestation and CO2 emissions are just a few of the environmental concern's society is facing today. Despite the global efforts being made toward different environmental policies, environmental crimes have gradually increased (Ramírez & Palos-Sánchez, 2018). Internationally, there is an increased concern about the negative environmental impact of organisational activities (Bakan, 2004; Osborne & Ball, 2011). Nevertheless, research has focused mostly on trends in environmental disclosure by big corporations (Deegan et al., 2002), and attention to environmental transparency in the public sector has been rather low (Lodhia et al., 2012).

In terms of environmental disclosure in the public sector, a number of studies have used as a basis for content analysis (Dumay et al., 2010; Farneti & Guthrie, 2009; Lodhia et al., 2012) the Sustainability Reporting Guidelines by the Global Reporting Initiative (GRI). The GRI guidelines, developed in 1997, are the most developed sustainability reporting standards based on the triple bottom line approach (economic, environmental and social indicators), and for more than a decade, they have been the leading reporting framework for sustainability disclosure worldwide (Alazzani & Wan-Hussin, 2013; Alonso-Almeida et al., 2014; Ballou & Heitger, 2005; KPMG International, 2017; Roca & Searcy, 2012).

The organizations interested in GRI are not only companies, but governments, since widespread sustainability reporting can help drive progress toward sustainable development goals (GRI, 2019) and can be the basis of environmental information disclosure that is regarded as a prerequisite for local socioeconomic development and is a basic requirement of a transparent government (Kosajan et al., 2018). The environmental disclosure reported by the governments studied is not limited exclusively to the impact of their institution on the environment, but also takes into account any environmental information or action interesting to citizens based on the 300 series of GRI Standards issued in 2016, that is composed by the thematic standards that report the material impacts of an organization regarding environmental issues.

However, despite the existence of standardized environmental framework, public awareness is key to making a success in fighting environmental problems (Easman et al., 2018; Knee Tan et al., 2008). For this, there must be a well-informed public. Since disclosing environmental information to the public offers an opportunity for them to

understand and develop stewardship about their environmental entities (Spash, 2002; Zheng et al., 2014) and they can increase their support to environment actions (Easman et al., 2018).

Environmental information disclosure is a significant subfield of government information disclosure (Kosajan et al., 2018) and having it from the government is an essential requirement for the exercise of citizenship (Quiroga, 2019). Governments worldwide have embraced environmental information disclosure as an indispensable key of their strategies to improve environmental conditions (Chen & Ting Cho, 2019). This means that the responsibility for disclosure of this information must be borne by all and sundry at all levels- national, regional and local (Oyero et al., 2018). Specially, the local government is at a relevant level to undertake the strategies of environmental governance (Wu et al., 2020), since they are the institutions more close to citizens to create them environmental public awareness. Although environmental information disclosure by local governments has been shown as a useful tool, for example for pollution control (Tian et al., 2016), their evidence has been understudied (Switzer, 2019).

Notwithstanding, many efforts to disclose citizens about environmental issues are not translated into a large degree of public awareness if there are ineffective communication strategies (Mooney et al., 2009). Unlike traditional communication media, social media (SM) allow for immediacy in information sharing and offer stakeholders more possibilities for interaction (Suárez-Rico et al., 2018). Criado and Villodre (2018) point out the rapid adoption of SM by public administrations. Taking into account that, 49 percent of the world's total population are SM users (We are social & Hootsuite, 2020), SM can be utilized as a tool for reaching all of them and both greenwash or raise awareness against environmental issues (Macotela & Burman, 2016). Thus, there is a need for more in-depth analysis of the extent and drivers of voluntary environmental disclosure in the public sector using these platforms.

Etter (2014) and Dutot, Lacalle Galvez, and Versailles (2016) indicated that Twitter is currently being widely used as a tool for environmental disclosure. To their knowledge, there is no previous study examining environmental disclosure by local governments via Twitter. In the present study, the authors aim to analyse the extent of Twitter environmental reporting by Andalusian municipalities (Spanish region) and to identify related determinant factors of such a disclosure. Factors such as population, geolocation,

political signs and sustainable commitments were analysed following the premise of the legitimacy theory. For the purposes of this study, a Twitter Environmental Disclosure Index (TEDI) was developed based on the GRI 300 standards to conduct an automated content analysis. Thus, through this study, the authors seek to shed more light on the drivers of environmental transparency in local government via Twitter.

According to recent international statistics, Spain has the second highest usage of Twitter in Europe (Statistic, 2018). The Andalusian municipalities have been chosen for further analysis because it is the region with the highest population in Spain (INE, 2017) and a leading region in the use of SM (Fundación Orange, 2014; Fundación Telefónica, 2016). SM are a major channel for online communications, and local governments are seizing this opportunity (Haro-de-Rosario, Sáez-Martín, & Caba-Pérez, 2018). A novel aspect of the present study is the focus on environmental disclosure via Twitter by local governments and the robustness of the study, as the analysis has considered nearly every tweet by each municipality since they started their account.

This paper addresses two research questions: RQ1: How do local governments use Twitter to divulge environmental issues? and RQ2: What are the factors that influence the environmental disclosure of local governments on Twitter? Their findings provide a contribution to the understanding of how and why local governments disclose environmental information. The administrators of SM in local governments can take advantage of the findings drawn in this study to better understand the general trend of environmental disclosure in public sector and plan the future communication strategies.

After offering a brief introduction in this section, the rest of the article is organised as follows: the authors present a review of previous studies in the following section, related to environmental reporting. The next section explains the data used in the research and the methods followed in this analysis. Later, the findings on the environmental disclosure on Twitter of the Andalusian municipalities are presented and discussed. The conclusions and contributions of the study are presented. Finally, the main limitations and avenues for future investigations are discussed.

3.2. LITERATURE REVIEW

3.2.1. Environmental Reporting

Over the last two decades, environmental disclosure by corporations has dramatically increased as a response to environmental concerns and social pressure. As a result, the number of companies paying attention to environmental concerns and providing information about their environmental impact, in addition to their financial performance, has significantly increased (Serafeim, 2013). KPMG International's Corporate Social Responsibility (CSR) reporting survey (2017), analysing the 100 largest companies in 49 countries, reveals that 72% of these companies provide a sustainability report which includes information on the economic, environmental and social performance of the company.

Although there are many standards offering guidance on how to report on environmental issues, there is no one internationally recognised and generally accepted standard for environmental disclosure, as there is for financial reporting (Marimon, Alonso-Almeida, Rodríguez, & Cortez, 2012). However, international institutions such as GRI represent a significant step towards unification in this matter.

The majority of research analysing environmental disclosure by companies shows that it is a tool to achieve a certain degree of legitimacy with stakeholders (Deegan et al., 2002; Lodhia, 2004). On the other hand, public sector environmental disclosure has not increased as dramatically as it has in the private sector (Lodhia et al., 2012), and there is relatively little research or theoretical framework on why public sector entities engage in environmental reporting (Burritt & Welch, 1997; Guthrie et al., 2010). Dumay et al. (2010) provided a review of GRI sustainability reports issued within the public sector, indicating that only a few entities have issued a sustainability report in compliance with these guidelines. Some authors claim that public sector entities should act as a role model to guide the private sector into appropriate practices in sustainability accounting (Guthrie et al., 2010; Osborne & Ball, 2011).

3.2.2. Legitimacy Theory

One of the most widely used approaches to justify the disclosure of sustainability information focused on the legitimacy theory (Deegan et al., 2002; García-Sánchez et al., 2013). In short, the theory of legitimacy is about meeting expectations of society as implied in the social contract (Richardson, 1987). Dowling and Pfeffer (1975) see

146

legitimacy as a harmonisation of organisational practices and social values.

Prior use of this theory has mostly focused on the environmental reporting of companies (Deegan & Rankin, 1996; Gray et al., 1995; Patten, 1991). Numerous studies show that companies exposed to public pressure, usually from those operating in the critical sector, tend to disclose more environmental information to gain legitimacy. Some companies with poor environmental performance even use environmental disclosure as a tool for greenwashing (Cho & Patten, 2007; Deegan et al., 2002; Lodhia, 2004).

It is that in some investigations (Burritt & Welch, 1997; Farneti & Guthrie, 2009; G. R. Frost & Seamer, 2002; Lodhia et al., 2012) the legitimacy theory has been applied to public sector disclosure, despite the reasons behind the interest of public agencies in revealing how they address sustainability issues do not differ from those of private companies (Lamprinidi & Kubo, 2008).

Burritt and Welch (1997) found that public sector entities with greater visibility tend to report more environmental information. Broadbent, Laughlin and Alwani-Starr (2010), on the other hand, stated that increased environmental reporting is actually a result of a regulatory push and claimed that normative forces are powerful drivers for sustainability practices in the public sector.

In short, despite the fact that sustainability disclosure practices in the public sector are in their infancy compared to the private sector (Dumay et al., 2010; Leeson et al., 2005), governments have as part of their original functions providing better information on sustainability activities (Ball & Bebbington, 2008).

In this way, they face public pressure, which requires them to legitimize that their activities are socially responsible, as well as responsible in terms of sustainability (García-Sánchez et al., 2013), given the fact that the public sector operates with funds from citizens, they demand more and more information and transparency about their public actions (Guillamón, Rios, et al., 2011). However, legitimacy is threatened when it is only about symbolic actions and not facts actions (Berrone et al., 2009). In addition, Ferejohn (1999) argues that politicians who want to improve the size of the public sector must increase the dissemination of information to receive more resources and obtain the trust of voters.

3.2.3. Social Media in the Public Sector

The rapid adoption of SM by public administrations deserves attention (Criado & Villodre, 2018). Incorporating SM into the local administration communication strategy provides transparency to local governments and improves policy-making and the provision of public services (Bonsón et al., 2012). SM platforms may become the new local discussion forums, where local governments send local service–related messages to their citizens and may serve as information exchange channels to obtain feedback from citizens (Haro-De-Rosario et al., 2018).

Thus, SM is an effective means for local government to improve citizens' trust in government (Song & Lee, 2016), allowing citizens and government to get closer and they can co-created information, citizens demand services, policy is negotiable, and governance is shared (Reddick & Norris, 2013). Thereby SM decreases information asymmetry between government functionaries and citizens, and it is empowered citizens to expand their role in dealing with public problems (Eom et al., 2018). Highlighting the SM's role as a tool for generating beneficial effects in the public sector.

Despite its beneficial effects, the decision of local governments to adopt SM practices is driven, according Mergel (2013), by in some cases they actively search for information and existing best practices and in other cases they passively observe and copy other institutions' behaviour.

3.2.4. Twitter as a Tool for Environmental Disclosure in the Public Sector

SM are powerful communication tools, allowing for the scale-free dissemination of information (Wukich & Steinberg, 2013). Millham and Atkin (2018) point out that the dynamics of sharing information via SM responds to their innate need for communication. Among the different existing SM platforms, the most used by governments were Facebook, Twitter, YouTube and Instagram (Contreras-Orozco, 2017). However, Twitter is the most popular SM in world politics (BWC, 2019).

Twitter is an example of less-constrained communication representing a millennial style, which is short, quick, and interactive. It is an innovative media platform with open and horizontal networks (Honeycutt & Herring, 2009; Lerman & Ghosh, 2010), which grants users access to a large amount of content and it provides a more interactive and open communication than other SM in where users are allowed to follow others without their

approval as well as trending topics without having to login (Kim, 2015). For these reasons, Twitter is the SM's platform preferred among public administrations, since it allows to communicate with others who have similar interests, regardless of whether users know each other, and disseminate information to a broad range of communities (Gao & Lee, 2017).

That is why it has gained so much popularity and currently counts more than 330 million monthly users exchanging more than 500 million messages every day (Suárez-Rico et al., 2018). Although the growth of active users has moderated, Twitter has created a great community that, for now, shows a strong loyalty (Sánchez, 2018).

Twitter's functionalities can assist in communicating information about environmental issues (Mooney et al., 2009). Busch and Shepherd (2014) claim that one of the main factors that has made Twitter an attractive tool for sustainability disclosure is the perception of democratic participation, related to more opportunities for social activism, digital citizenship and free speech—something that is only possible in a two-way media format. In addition, Akerlof and Maibach (2008) indicated that higher public awareness achieves when the environmental campaigns have higher rates of message frequency and for that, Twitter is the ideal platform where you can post short messages frequently.

Although there are some studies on Twitter in the public sector, the literature on Twitter in local governments is rather scarce (Anderson et al., 2015; Criado & Villodre, 2018; Sobaci & Karkin, 2013) and almost non-existent in the use of Twitter on environmental issues (Hodges & Stocking, 2016; Shan et al., 2020). A study by Wukich and Steinberg (2013) analysed how the use of hashtags facilitates the dissemination of information during extreme events. Haro-de-Rosario et al. (2018) analysed the usage of Facebook and Twitter as tools for citizens' commitment with Spanish local governments. Bonsón, Perea and Bednárová (2019) studied Twitter usage and citizens' engagement in Andalusian local government.

3.2.5. Factors Behind Environmental Disclosure

For the second research question (RQ2: What are the factors that influence the environmental disclosure of local governments on Twitter?) the previous literature has presented that there are factors that may either increase or slow environmental disclosure by governments. They include economic factors, municipal features and political factors.

Economic Factors

To carry out any environmental action the municipalities need to have an economic sustenance, which they obtain from their public budgets. This indicator is representative of good management of local government (Andrews, 2010)**.** The balance of the positive budget (surplus) allows municipalities to improve their information systems (Alt et al., 2006) and thus increase environmental disclosure. In contrast, with a negative budget balance (deficit), municipalities usually are more transparent (Guillamón, Rios, et al., 2011), although other authors (García-Sánchez et al., 2013; Navarro et al., 2010) find no evidence that environmental disclosure is favored by the budget balance.

The unemployment rate, which is strongly related to the economic level of the municipality (Alonso-Villar et al., 2009), has been analyzed in various investigations showing that it affects the environmental disclosure of municipalities in different scenarios. (Guillamón, Rios, et al., 2011; Navarro et al., 2011). However, other authors (García-Sánchez et al., 2013; Prado-Lorenzo et al., 2012) have not found a significant relationship.

Municipal Features

Among between, there are differences regarding of population size, so that their behavior will be different in some respects between a large municipality and a small municipality (McElroy et al., 2005). Several authors (G. R. Frost & Seamer, 2002; García-Sánchez et al., 2013; Joseph & Taplin, 2011) obtain evidence in favor of the fact that large municipalities disclose more environmental information, since they should be more transparent to legitimize their functions because they have a higher degree of visibility, for which attracts the attention of politicians, environmental groups and the general public. In contrast, neither Prado-Lorenzo et al. (2012) nor Sánchez de Miguel (2019) found a significant relationship of population size in environmental disclosure.

The location of the municipality (coast or inland) is usually an indicator of the municipality's development (Ribeiro & Guzman, 2011), which is linked in Spain with its main productive sector, tourism (WTTC, 2020). Despite the fact that tourism activity generates positive impacts in the municipality's environmental sphere, the negative impacts have been greater and more visible as they are direct impacts on the physical environment (Gómez Bruna & Martín Duque, 2019). Some authors have concluded that

the harmful impacts of tourism on the environment they are perceived more negatively in coastal municipalities than in inland municipalities (Gómez Bruna & Martín Duque, 2019; Zahedi, 2008), which implies that coastal municipalities should disclose more about the environment to legitimize the actions of the negative impact of tourism on its citizens. However, this does not only occur in the public sector since keeping in mind that the reasons behind legitimizing the disclosure of how they address sustainability problems in the public sector do not differ from the private sector (Lamprinidi & Kubo, 2008; Liu & Anbumozhi, 2009) Chinese companies operating in coastal regions are more likely to disclose sustainability-related data. However, other authors (Ribeiro, 2007; Ribeiro & Guzman, 2011) have pointed out that the geolocation of the municipalities has no association with their environmental disclosure.

Political Factors

The ideology of the ruling party in each Spanish municipality is framed in left-wing blocks (progressive) and in right-wing blocks (conservatives) (CIS, 2015), which are not characterized by the agreement culture of the pacts between the different ideological blocks compared to Europe (Aunión et al., 2020). Although the legislature lasts four years, in Spain there is no maximum limit of legislatures to national or municipality level, so the president or mayor can be re-elected in several consecutive elections (Rodríguez-Pina & Mateo, 2017). As Andreu-Abela and Romero-Reche (2019) present, that at national level the party chosen to govern changes more while at the municipal level there is greater continuity of the ruling party. They explain that this is because in the behavior of the Andalusian voter, the contextual factors are basic, both the roots of the formation and the habitat seem effective predictors of the vote in this community. For this reason, at the municipal level, a party with roots has a much greater chance of being voted for than another, without headquarters, infrastructure and regular activity in the territory.

This means that the political sign of the municipal government can influence sustainable dissemination practices, given that different ideologies often propose different styles of city (Prado-Lorenzo et al., 2012). However, in the literature there are disparities in conclusions about how municipalities report on environmental matters according to their political sign. On the one hand, some authors have found a negative relationship between right-wing ideology and the implementation of sustainable practices, while other authors have presented that it is left-wing governments that negatively influence sustainable

practices, since right-wing parties dedicate additional efforts regarding the environment to attract voters with a left-wing ideology (Prado-Lorenzo et al., 2012). On the other hand, Guillamón et al. (2011) and García-Sánchez et al. (2013) show that municipalities governed by left-wing majorities are more transparent than those governed by conservatives. However, Navarro et al. (2010) find that the political tendency of a government party does not explain the environmental disclosure of the public sector.

It has been observed elsewhere that local governments seeking to address environmental issues frequently join urban sustainability commitment networks (Anguelovski & Carmin, 2011; Bulkeley, 2010; Cashmore & Wejs, 2014). It is one of the indicators of transparency and cooperation that determine the sustainability of cities according to the 2030th Agenda for Sustainable Development (Gobierno de España, 2018). Sustainable cities are those that have established action plans and policies that aim to guarantee the availability and reuse of the environment resources for future generations (Regional Environmental Center for Central and Eastern Europe, 2010). The association with city networks for sustainability generates good results (Observatorio de la Sostenibilidad, 2018). The highlighted networks are Aalborg Charter, Covenant of Mayors for Climate and Energy (CoM), among others. Their mission is to mobilize and sensitize society, public institutions and the private sector on sustainable matters (REDS, 2015), so if they are associated with more networks , the more they must disclose about the sustainability to legitimize their agreements, which makes it a considerable factor for the analysis.

3.3. METHODOLOGY

3.3.1. Sample selection

Andalusia is the leading Spanish region in the use of social media (Fundación Orange, 2014; Fundación Telefónica, 2016). Three of its cities, Seville, Granada and Malaga, are among the five Spanish cities with the highest number of SM profiles related to their population (The Social Media Family, 2018). Hence, Andalusia seems to be an interesting sample for social media research. In this study, all 153 Andalusian municipalities with more than 10,000 inhabitants are analysed. Nearly 80% of the Andalusian population resides in these municipalities.

To identify the Twitter accounts of the selected municipalities, a multi-track search strategy was carried out as follows: (1) Search for logos or Twitter links on the homepage of the municipality website. If the Twitter/link logo was not available on the home page,

the site map was checked for a link to a Twitter account or any other relevant link that could redirect to Twitter, e.g. a link to 'social media', 'contact us' or 'connect with us'. (2) If the site map search did not lead to a link to a Twitter account, then an Internet search engine was used to search for the words 'Twitter' next to the name of the municipality. Therefore, when searching with the keywords, the search results return accounts that contain those words and allow the official municipality account identification. (3) If neither the municipality's website nor the Internet search engine showed any sign of a Twitter account, then Twitter itself was used to search for the name of the municipality. If a Twitter account was found for a particular municipality, it was then verified by searching the bibliography provided by the Twitter account, or by checking whether the Twitter account had a link that redirected to the municipality's website. This verification step was important to make sure that the accounts that were found are authentic. If a municipality had several Twitter accounts, the main Twitter account, which generally only carries the name of the municipality without further specifications, was the one to be included in the sample. Following these steps, 119 verified Twitter accounts were found from the sample of 153 municipalities.

3.3.2. Tweet extraction

The process of tweet extraction and environmental content analysis conducted in this study is depicted in Fig. 3.1.

Figure 3.1. Flowchart of scraping and environmental analysis.
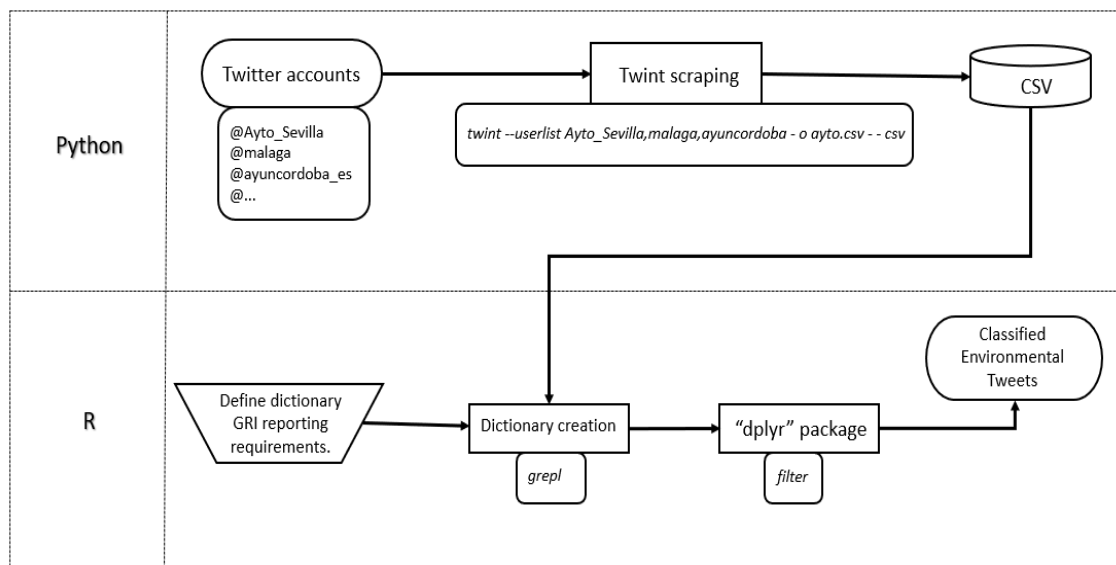
After the Twitter accounts were identified, the tweets were scraped and extracted via Twint (Fig. 3.1), a Python library that automates the Twitter gathering process (Zacharias

& Poldi, 2018). It is an advanced Twitter scraping and open source intelligence tool that is designed to massively extract the history of the tweets that were tweeted by each municipality's account. However, Twint is not able to scrape retweets as it does original tweets. Therefore, this study only analyses the original tweets from each account. Nevertheless, these are of greater importance, as only these tweets can reflect the intention of the municipality to communicate certain information via social media.

The tweets were extracted at the end of March 2019, producing 817,903 tweets ranging from the period each municipality joined Twitter (average year 2013) to 15 March 2019, representing about 80% of the total number of tweets published by the municipalities studied. The remaining 20% are retweets, which cannot be collected automatically.

3.3.3. Creation of dictionaries

The identification of the environmental tweets was based on a Spanish keyword list (dictionary) based on the Global Reporting Initiative (GRI) information requirements for environmental disclosure (300 series) (Fig. 1).

The dictionary is based on GRI keywords because GRI standards represent global best practices for publicly reporting a variety of environmental, economic and social impacts (GRI Standards, 2018). As previous research has shown, the GRI framework has already been used as the basis for the analysis of environmental disclosure content (Dumay et al., 2010; Guthrie & Farneti, 2008; Lodhia et al., 2012). Sustainability reports based on the standards provide information about an organisation's positive or negative contributions to sustainable development (GRI Standards, 2018). The 300 series of the GRI Standards include the standards for specific environmental issues: Materials (301), Energy (302), Water and Effluents (303), Biodiversity (304), Emissions (305), Effluents and Waste (306), Environmental Compliance (307) and Supplier Environmental Assessment (308). Thus, the dictionary is composed of 92 keywords from these eight specific topics plus a generic topic. The reason for the elaboration of a dictionary of environmental key words was due to the lack of Spanish-language dictionaries in this field. The GRI 300 was chosen as a reference due to its robustness in terms of environmental indicators. They were obtained from GRI Standards download center, where the Environmental Standards Spanish translations are available. Once completed, the elaborated dictionary was applied to identify the municipalities' tweets with environmental content.

The coding of the dictionary (Fig. 1) was performed using the function of the R base package, grepl (R Core Team, 2018), where tweets containing at least one of the key words from the dictionary have been identified. Once the tweets had been analysed and the environmental disclosure tweets had been identified, they were automatically classified (Fig. 1) using the R 'dplyr' library (Wickham et al., 2017). The dplyr library is a powerful R package for transforming and summarising tabular data with rows and columns. It is very useful when performing analysis and manipulation of exploratory data. The package contains a set of functions that perform common data manipulation operations, such as filtering rows, selecting specific columns, rearranging rows, adding new columns, and summarising data (Irizarry & Love, 2017). The filter function was used to sort tweets by category. This way, a new database was obtained, containing 18,675 tweets which correspond exclusively to environmental disclosure tweets. Those were used for further statistical analysis.

3.3.4. Twitter Environmental Disclosure Index (TEDI)

Once the database of environmental information tweets was obtained, the tweets were paired with their corresponding municipalities. This resulted in the possibility of creating an index that measures the environmental dissemination of Twitter by, in this case, the Andalusian municipalities. Thus, the Twitter Environmental Disclosure Index (TEDI) is calculated for each municipality considering its number of environmental tweets and its total number of tweets (TEDI = number of environmental tweets/total number of tweets).

3.3.5. Measurement of variables

Table 3.1 below summarizes the variables used in this study and their measurements.

Dependent variable. The presence of environmental disclosure tweets is measured by the Twitter Environmental Disclosure Index (TEDI) as the percentage of environmental tweets tweeted by each municipality since they joined Twitter with respect to their total number of tweets. It lets you know how the environmental commitment of the municipalities in Twitter.

Independent variables. The variables used in this study are the result of balance (surplus or deficit) of current budget by inhabitant of each municipality (Government Budget Balance by Inhabitant), the proportion of unemployed (Unemployment Rates), whether it is a coastal or inland municipality (Geolocation), the left-wing or right-wing political

ideology governing the municipality (Political Sign), the number of inhabitants of each municipality (Population) and the number of institutional urban environmental commitments to which the municipality is attached (Sustainability Commitment Networks). For each of these variables, there is a justification following legitimacy theory, which seeks to explain which of these variables lead to greater environmental disclosure on Twitter. These variables refer to the year 2018. Both 2018 unemployment rate and budget are used as a proxy for the evolution of both indicators over the years analyzed in a period of recovery of the Spanish economy (Hernández de Cos, 2018).

Variable	Full Name	Shortened Name	Description	Source
Dependent	Twitter Environmental Disclosure Index	TEDI	Proportion of environmental tweets tweeted by each municipality	Calculated and assigned based on environmental topic of tweets extracted via Twint
Independent	Government Budget Balance by inhabitants	GovBudgBalH	Result of balance (surplus or deficit) of current budget by inhabitants of each municipality.	Ministerio de Economía y Hacienda of Spain Government
	Unemployment Rates	UnempRat	Proportion of people who can work and actively seek employment but do not get it in each municipality,	Instituto de Estadística y Cartografía de Andalucía (IECA)
	Population	Popul	Number of inhabitants of each municipality.	
	Geolocation	Geol	Dummy Variable (If it is a coastal municipality = 1; If it is an inland municipality = 0)	Website of municipalities themselves
	Political Sign	PolSign	Dummy Variable (If a left-wing political party governs = 1; If a right-wing political party governs = 0)	
	Sustainability Commitment Networks	SustCommitNet	Number of institutional urban environmental commitments to which the municipality is attached (0-10)	Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible de la Junta de Andalucía

Table 3.1. Variables' Definition and measurement.

After selecting the sample (119 municipalities) with all its scraped data (817,903 tweets), the identification of environmental tweets (18,774 tweets), the creation of TEDI (dependent variable) and the definition of variables (six independent variables), the following linear regression and ordinary least squares (OLS) was presented:

$$(TEDI = \alpha + \beta1 GovBudgBalH + \beta2 UnempRat + \beta3 Popul + \beta4 Geol + \beta5 PolSing + \beta6 SustCommitNet + \epsilon)$$

3.4. FINDINGS

RQ1: How do local governments use Twitter to divulge environmental issues?

The results show that 119 (77.78%) of the 153 largest municipalities in Andalusia are present on Twitter and use it as a channel for communication with their citizens and other stakeholders.

Regarding the scraped tweets, about 80% of the original tweets were obtained, for a total of 817,903. Following the elaborated environmental dictionary that was created based on the GRI keywords (300 series), only 18,675 (2.30%) of the total tweets were considered environmental.

As for the total number of followers (audience), the number of followers with respect to the population (penetration), the total number of tweets (activity total), the number of tweets per business day (daily activity) and the environmental disclosure index (TEDI), there were evident substantial differences between the municipalities analyzed (Table 3.2). The account with the largest audience had 156,702 followers, while the account with the smallest audience had only 179 followers (average = 5,608, std. = 19,066). Similarly, the largest penetration was 29.78%, while the lowest was as scant as 0.81% (average = 9.90%, std. = 6.24%). In addition, it has been found that there is a negative relationship between population and penetration (r_s = -0.234). The differences were also present in the level of Twitter activity, where the most active Twitter account had made 121,217 tweets and the least active only 284 tweets (average = 8,484, std. = 12,783). Regarding frequency of posting, the most active account per business day published 65 daily tweets, while the least active tweeted only 0.32 messages per day (average = 5, std. = 6.86). The Twitter Environmental Disclosure Index (TEDI) ranged from 0.47% to 16.67% (average = 2.24%, std. = 1.96%).

	Maximum	**Average**	**Minimum**	**St. D.**
Audience	156,702	5,608	179	19,066
Penetration	29.78%	9.90%	0.81%	6.24%
Activity total	121,217	8,484	284	12,783
Daily activity	65	5	0.32	6.86
TEDI	16.67%	2.23%	0.47%	1.96%

Table 3.2. Audience, Penetration Activity, Daily activity and TEDI.

RQ2: What are the factors that influence the environmental disclosure of local governments on Twitter?

To identify the factors explaining municipality environmental disclosure via Twitter, Ordinary Least Squares analysis was applied (Table 3.1). Table 3.3 presents the results. As can be seen, both the government budget balance (Sig. 0.0165*) and sustainable commitments (Sig. 0.0025**) seem to be positively correlated with TEDI. Nevertheless, other variables tested did not show any significant relation with TEDI.

The results show that municipalities with budget surplus tend to post more environmental tweets than municipalities with budget deficit and that mainly municipalities attached to a greater number of sustainability commitments networks also to post more environmental tweets than those less attached. Even though the estimate coefficients of both are very low, being adhered to more sustainability commitment networks implies more environmental disclosure on Twitter than the increase in the surplus.

The adjusted R-squared value is also low (0.06471), so the proportion of variation in the dependent variable that has been explained by this model is low. This does not indicate whether a regression model is adequate, since in this case it is possible to have a low R-squared value for an adequate model (p-value: 0.03566). Any discipline that attempts to predict human behavior typically has low R-squared values, as humans are simply difficult to predict (J. Frost, 2019).

Independent variable	Dependent variable			
	TEDI			
	Estimate	Std. Error	t value	Sig.
(Intercept)	-1.797e-03	8.087e-03	-0.222	0.82459
Government budget balance by inhabitant	3.735e-05	1.571e-05	2.378	0.01911 *
Unemployment rates	1.210e-06	1.817e-06	0.666	0.50693
Population	-1.390e-07	2.022e-07	-0.687	0.49319
Geolocation (coastal vs. inland)	-1.161e-03	3.996e-03	-0.291	0.77188
Political sign (left-wing vs. right-wing)	4.039e-03	4.220e-03	0.957	0.34058
Sustainable commitments networks	4.461e-03	1.455e-05	3.065	0.00273**

*Significant at p<0.05 (2-tailed) ** Significant at p<0.01 (2-tailed)*
Multiple R-squared: 0.1118, Adjusted R-squared: 0.06417
F-statistic: 2.349 on 6 and 112 DF, p-value: 0.03566

Table 3.3. Ordinary Least Squares (OLS)

3.5. DISCUSSION

Local governments must inform about their sustainability activities (Ball & Bebbington, 2008). On the other hand, citizens must be provided with accurate information about environmental issues and should receive this through the most effective communication channels available (Mooney et al., 2009). This study has been carried out under both premises of public awareness and citizen pressure.

According to the findings, most Andalusian municipalities (77.78%) have an official Twitter account. This presence on Twitter is relevant, although somewhat smaller compared to that reported (96.55%) by Bonsón et al. (2019). However, the sample in that study included bigger municipalities. This is consistent with the assumption that bigger municipalities can afford to maintain more SM channels. The Twitter presence in Andalusian municipalities is also relevant when compared with SM usage in other Western European municipalities as reported by Bonsón, Royo, and Ratkai (2015)—79% for Facebook, and Bonsón and Bednárová (2018)—39% for YouTube. This makes Twitter an important communication channel for public sector issues, where municipalities can leverage on its specific features.

Nevertheless, a simple presence on Twitter does not guarantee an active and fruitful communication between the municipality and its audience (Bonsón et al., 2017). Relevant content is one of the key aspects to gain an audience's attention. This way, the municipality can leverage Twitter and use it as a dissemination channel for various public issues or initiate a conversation with citizens.

The results show that the audience (number of followers) varies considerably depending on the municipality. When the audience is considered in relative terms—followers with respect to population—an inverse relationship has been obtained between municipality size and penetration. Penetration is lower when the population increases. The findings show that in the larger municipalities the audience feels less connected to the municipality, which is in compliance with previous research (Bonsón et al., 2019). The average penetration rate on Twitter was 9.9%, which reflects relatively small interest on the part of the Andalusian population in following their municipalities on Twitter in general.

To attract more followers, municipalities should use Twitter in an effective way. For instance, activity should be frequent, but not overwhelming (Bonsón et al., 2017). The

total Twitter activity of the municipalities in this study varies. An average daily activity was five tweets per business day, which would follow the recommendations of the UK Government Cabinet Office, which in their guidelines suggests 2 to 10 publications per day to be an adequate frequency for SM publications.

Regarding environmental disclosure, the results show rather little concern on the part of the municipalities for environmental issues on Twitter, as environmental tweets (TEDI) only represent 2.30% of the total number of tweets.

Despite Twitter being an attractive tool for corporate environmental disclosure (Busch & Shepherd, 2014; Dutot et al., 2016; Etter, 2014), municipalities do not seem to leverage the opportunities this platform offers. Nevertheless, a similar phenomenon, a difference between corporate and public administration disclosure practices, has been observed with other SMs (Bonsón et al., 2015, 2017; Bonsón & Bednárová, 2018; Ribeiro et al., 2016). Despite that, citizens seem to be interested in the environmental actions that public entities carry out (Ribeiro et al., 2016). Bonsón et al. (2019) point out that environmental content generates the most comments from citizens. Therefore, a lack of attention to environmental issues from the municipality side might not satisfy the citizens' demand for public entity environmental legitimacy.

Regarding the factors influencing the level of environmental disclosure measured by TEDI, no association was found between population, geolocation, and political sign and TEDI. Later, the factors are mentioned for which there is empirical evidence.

The relationship between the unemployment rate and environmental disclosure on Twitter (TEDI) has not been significant. Therefore, it implies that neither the municipalities with the highest unemployment nor those with the lowest unemployment disclose more about the environment. This coincides with that obtained by García-Sánchez et al. (2013) and Prado-Lorenzo et al. (2012). However, the municipalities with the highest employment rate must focus on the environment, since an environmental tax reform reduces unemployment (Aronsson, 2005; Schneider, 1997), as shown by 'double dividend hypothesis' (Bosquet, 2000; Carraro et al., 1996).

Population has been chosen as a possible factor for TEDI based on the assumption that larger municipalities face greater environmental concerns, such as pollution and therefore, based on the premise of legitimacy theory, might use this alternative platform

for environmental disclosure. Nevertheless, previous research (Sánchez de Miguel, 2019) showed that the problem of pollution is not only a major issue in large provincial capitals; smaller municipalities face high levels of pollution as well. Similarly, as Prado-Lorenzo et al. (2012) concluded, this study the size of the municipality measured by the population was not associated with the TEDI.

Regarding geolocation, it was assumed that the coastal municipalities would disclose more environmental information to legitimize the environmental impacts of tourism in their environment, but it has not been significant with respect to TEDI, coinciding with Ribeiro (2007) and Ribeiro and Guzman (2011). Turns out that in Andalusia the tourism in both coastal and inland municipalities is similar; domestic tourism has improved but stays in sun and beach destinations have decreased (Agencia EFE, 2018). Therefore, the municipalities of both destinations must disclose environmental information. The coastal municipalities must legitimize the environmental situation because their higher seasonal component, which threatens sustainability (Martín et al., 2014) and the interior municipalities because the loss of quality of the 'climate' resource will make these regions go from excellent to unfavourable conditions for tourism (Moreno, 2010).

As for the ideology of the municipal government team, Greenpeace (2019) in its analysis of the electoral programs of the leading Spanish political parties, concluded that the left-wing political parties have better environmental proposals, while the right-wing political parties did not have environmental concerns as a priority. However, the findings do not indicate that a municipality under a left-wing government would have higher TEDI. Despite the fact that the Spanish government parties are among the most committed to their electoral promises, behind the British and Swedes, and significantly ahead of, for example, Austrians and Italians (Lapuente Giné, 2015), in their political programs there is still a lack of commitment and urgency in addressing the climate crisis and other environmental concerns (Greenpeace, 2019). This coincides with Navarro et al. (2010) that find that the political tendency of a government party does not explain the environmental disclosure of the public sector.

The factors that have empirical relationship with TEDI are government budget balance (by inhabitant) and especially sustainable commitments networks attached to each municipality.

The governments with a budget balance surplus tend to disclose more about the

environmental than the governments with deficit. Due to the surpluses, governments have more capacity to improve their information systems (Alt et al., 2006) and greater investment capacity, which correspond to higher levels of municipal transparency (Araujo & Tejedo-Romero, 2016; Guillamón, Bastida, et al., 2011).

The governments with a greater number of sustainable commitments networks tend to disclose more about the environmental than the governments with a few numbers of networks. Because the networks have the mission that the governments must mobilize and sensitize society, public institutions and the private sector on sustainable matters (REDS, 2015). The legitimacy is fostered through the increase of embedded networks (Frickel & Davidson, 2004), which are key tools for implementing a set of sustainability policies at local level (Echebarria et al., 2004). In addition, as most of the sustainable commitments networks are international, local governments thus legitimize their role in their own municipality, giving an international projection (Strangis, 2012). As Andalusia (Spain) is a region of the European Union (EU), they adhere to European networks that serve to disseminate and legitimize the environmental regulations of the EU (Kelemen, 2010). Bearing in mind the EU as a global environmental leader and the United States as an assiduous opponent of multilateral environmental agreements (Kelemen & Vogel, 2010). Membership of such networks could be symbolically significant for constructing legitimacy, but they also constitute a resource which municipalities can draw upon in attempting to construct legitimacy for the institutionalization of environmental planning (Cashmore & Wejs, 2014).

3.6. CONCLUSION

According to their knowledge, this is the first study that explores environmental disclosure via Twitter in the largest municipalities in Andalusia. As there is no previous study, this study provides an in-depth analysis and contributes to the debate on the use of SM in the public sector.

The contribution of this study is twofold. First, it fills the gap in the literature on the use of Twitter by municipalities for environmental disclosure and provides a dictionary of environmental keywords in Spanish based on the GRI. Second, it could have practical implications for administrators of public sector communities responsible for online communication. The findings of this study could help local governments to improve their online communication strategy. This paper can also establish the basis of a framework of

measures for the dissemination of environmental information on Twitter for the public administration. In this way, local governments would know the best way to tweet about it and it can control how they are doing it through TEDI.

The results show that most of the local governments in Andalusia have an official Twitter account with different levels of activity and audience but with little penetration of their population on Twitter and a publication of recommended tweets. Environmental disclosure on Twitter (TEDI) was still rather scarce in comparison to other content types.

It has been found that among the factors such as government budget balance (by inhabitant), unemployment rates, population, geolocation, political sign and sustainable commitment networks, only government budget balance and mainly sustainable commitment networks shows an association with TEDI. In a nutshell, it can be concluded that both municipalities with surplus and mainly municipalities with a greater number of sustainable commitments networks tweet more environmental content to legitimise their functions and actions.

3.7. LIMITATIONS AND FUTURE RESEARCH

Before closing, a series of limitations must be acknowledged, along with recommendations for future research.

The main limitation of this study is implicit to the creation of a dictionary and a content analysis. There is a possibility of omitting a relevant keyword which might have led to the exclusion of a tweet despite its environmental content. On the other hand, a tweet might have been classified as environmental because of the presence of an environmental keyword, but the context may not have been an environmental disclosure. Therefore, future research could attempt to design a more precise technique to reduce this limitation and get an even more precise environmental dictionary.

It would also be more accurate to be able distinguish between the tweets that report the impact of the municipality on the environment or the tweets that deal with generic environmental information that may be of interest to citizens.

As for the factors, the limitation is in the economic variables that have the peculiarity that they are not very static indicators in time, so they vary from one year to another. Therefore, for future investigations, a TEDI must be obtained for each year and panel data must be performed.

Regarding future research, the proposed analysis technique can be applied to other regions that have similar numbers of Twitter users, such as Catalonia, Valencia or Castilla y León (Delgado von Eitzen, 2016; The Social Media Family, 2018). To improve the generalisation and understanding of the results, future studies could conduct a comparative analysis on a national or international scale and extend the list of possible factors influencing a municipality's propensity to tweet environmental content. It could also be of great interest to analyse the commitment of citizens on Twitter and their demand for disclosure of different environmental matters by municipality.

REFERENCES

Agencia EFE. (2018). *El turismo urbano mejora en 2018 pero caen estancias sol y playa, según CEA | Confederación de Empresarios de Andalucía.* https://www.efe.com/efe/andalucia/economia/el-turismo-urbano-mejora-en-2018-pero-caen-estancias-sol-y-playa-segun-cea/50001111-3850742

Akerlof, K., & Maibach, E. W. (2008). "Sermons" as a Climate Change Policy Tool: Do They Work? Evidence From the International Community. *Global StudieS Review*, *4*(3). www.climatechangecommunication.org

Alazzani, A., & Wan-Hussin, W. N. (2013). Global Reporting Initiative's environmental reporting: A study of oil and gas companies. *Ecological Indicators*, *32*, 19–24. https://doi.org/10.1016/j.ecolind.2013.02.019

Alonso-Almeida, M. del M., Llach, J., & Marimon, F. (2014). A closer look at the "Global Reporting Initiative" sustainability reporting as a tool to implement environmental and social policies: A worldwide sector analysis. *Corporate Social Responsibility and Environmental Management*, *21*(6), 318–335. https://doi.org/10.1002/csr.1318

Alonso-Villar, O., del Rio, C., & Toharia, L. (2009). Un Análisis Espacial del Desempleo por Municipios. *Revista de Economía Aplicada* , *49*(XVII), 47–80.

Alt, J. E., Lassen, D. D., & Rose, S. (2006). The Causes of Fiscal Transparency: Evidence from the U.S. States. *IMF Staff Papers*, *53*. https://econpapers.repec.org/RePEc:pal:imfstp:v::y:2006:i:si:p:2

Anderson, M., Lewis, K., & Dedehayir, O. (2015). Diffusion of innovation in the public sector: Twitter adoption by municipal police departments in the U.S. *2015 Portland International Conference on Management of Engineering and Technology (PICMET)*, 2453–2464. https://doi.org/10.1109/PICMET.2015.7273207

Andreu-Abela, J., & Romero-Reche, A. (2019). *Cambios en el comportamiento electoral en Andalucía. Análisis del ciclo electoral 2018-2019 (autonómicas, generales y municipales).* https://www.centrodeestudiosandaluces.es/publicaciones/n-82-cambios-en-el-comportamiento-electoral-en-andalucia-analisis-del-ciclo-electoral-2018-2019-autonomicas-generales-y-municipales

Andrews, M. (2010). Good Government Means Different Things in Different Countries. *Governance*, *23*(1), 7–35. https://doi.org/10.1111/j.1468-0491.2009.01465.x

Anguelovski, I., & Carmin, J. A. (2011). Something borrowed, everything new: Innovation and institutionalization in urban climate governance. In *Current Opinion in Environmental Sustainability* (Vol. 3, Issue 3, pp. 169–175). Elsevier. https://doi.org/10.1016/j.cosust.2010.12.017

Araujo, J. F. F. E. de, & Tejedo-Romero, F. (2016). Local government transparency index: determinants of municipalities' rankings. *International Journal of Public Sector Management*, *29*(4), 327–347. https://doi.org/10.1108/IJPSM-11-2015-0199

Aronsson, T. (2005). Environmental policy, efficient taxation and unemployment. *International Tax and Public Finance*, *12*(2), 131–144. https://doi.org/10.1007/s10797-005-0498-4

Aunión, J. A., Sevillano, L., & Zafra, M. (2020, January 7). Europa, un continente de coaliciones más allá de España | España | EL PAÍS. *El País*.

https://elpais.com/politica/2020/01/06/actualidad/1578327420_776769.html

Bakan, J. (2004). *The corporation : the pathological pursuit of profit and power*. Free Press.

Ball, A., & Bebbington, J. (2008). Editorial: Accounting and reporting for sustainable development in public service organizations. *Public Money and Management*, *28*(6), 323–326. https://doi.org/10.1111/j.1467-9302.2008.00662.x

Ballou, B., & Heitger, D. L. (2005). *The Rise of Corporate Sustainability Reporting: A Rapidly-Growing Assurance Opportunity*. www.globalreporting.org

Berrone, P., Gelabert, L., & Fosfuri, A. (2009). The Impact of Symbolic and Substantive Actions on Environmental Legitimacy. *IESE Business School Working Paper No. 778*. https://doi.org/10.2139/ssrn.1349063

Bonsón, E., & Bednárová, M. (2018). The use of YouTube in western European municipalities. *Government Information Quarterly*, *35*(2), 223–232. https://doi.org/10.1016/J.GIQ.2018.04.001

Bonsón, E., Perea, D., & Bednárová, M. (2019). Twitter as a tool for citizen engagement: An empirical study of the Andalusian municipalities. *Government Information Quarterly*. https://doi.org/10.1016/J.GIQ.2019.03.001

Bonsón, E., Royo, S., & Ratkai, M. (2015). Citizens' engagement on local governments' Facebook sites. An empirical analysis: The impact of different media and content types in Western Europe. *Government Information Quarterly*, *32*(1), 52–62. https://doi.org/10.1016/J.GIQ.2014.11.001

Bonsón, E., Royo, S., & Ratkai, M. (2017). Facebook Practices in Western European Municipalities. *Administration & Society*, *49*(3), 320–347. https://doi.org/10.1177/0095399714544945

Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, *29*(2), 123–132. https://doi.org/10.1016/J.GIQ.2011.10.001

Bosquet, B. (2000). Environmental tax reform: Does it work? A survey of the empirical evidence. *Ecological Economics*, *34*(1), 19–32. https://doi.org/10.1016/S0921-8009(00)00173-7

Broadbent, J., Laughlin, R., & Alwani-Starr, G. (2010). Steering for Sustainability. *Public Management Review*, *12*(4), 461–473. https://doi.org/10.1080/14719037.2010.496257

Bulkeley, H. (2010). Cities and the Governing of Climate Change. *Annual Review of Environment and Resources*, *35*(1), 229–253. https://doi.org/10.1146/annurev-environ-072809-101747

Burritt, R. L., & Welch, S. (1997). Accountability for environmental performance of the Australian Commonwealth public sector. *Accounting, Auditing & Accountability Journal*, *10*(4), 532–561. https://doi.org/10.1108/09513579710367494

Busch, T., & Shepherd, T. (2014). Doing well by doing good? Normative tensions underlying Twitter's corporate social responsibility ethos. *Convergence: The International Journal of Research into New Media Technologies*, *20*(3), 293–315. https://doi.org/10.1177/1354856514531533

BWC. (2019). *World Leaders on Facebook 2019. Burson Cohn & Wolfe*.

Carraro, C., Galeotti, M., & Gallo, M. (1996). Environmental taxation and unemployment: Some evidence on the "double dividend hypothesis" in Europe. *Journal of Public Economics*, *62*(1–2), 141–181. https://doi.org/10.1016/0047-2727(96)01577-0

Cashmore, M., & Wejs, A. (2014). Constructing legitimacy for climate change planning: A study of local government in Denmark. *Global Environmental Change*, *24*(1), 203–212. https://doi.org/10.1016/j.gloenvcha.2013.09.019

Chen, W. Y., & Ting Cho, F. H. (2019). Environmental information disclosure and societal preferences for urban river restoration: Latent class modelling of a discrete-choice experiment. *Journal of Cleaner Production*, *231*, 1294–1306. https://doi.org/10.1016/j.jclepro.2019.05.307

Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society*, *32*(7–8), 639–647. https://doi.org/10.1016/j.aos.2006.09.009

CIS. (2015). *Indicador de confianza del consumidor. Mes de octubre. Tabulación por recuerdo de voto y escala de ideología*.

Contreras-Orozco, L. (2017). Las redes sociales digitales como factor de proximidad entre la sociedad y los gobiernos subnacionales en México. *Núm*, *6*(12), 225–249. https://doi.org/10.23913/ricsh.v6i12.131

Criado, J. I., & Villodre, J. (2018). Comunicando datos masivos del sector público local en redes sociales. Análisis de sentimiento en Twitter. *El Profesional de La Información*, *27*(3), 624. https://doi.org/10.3145/epi.2018.may.14

Deegan, C., & Rankin, M. (1996). Do Australian companies report environmental news objectively? *Accounting, Auditing & Accountability Journal*, *9*(2), 50–67. https://doi.org/10.1108/09513579610116358

Deegan, C., Rankin, M., & Tobin, J. (2002). An examination of the corporate social and environmental disclosures of BHP from 1983-1997. *Accounting, Auditing & Accountability Journal*, *15*(3), 312–343. https://doi.org/10.1108/09513570210435861

Delgado von Eitzen, C. (2016). *Perfil del usuario de Twitter en España en 2016*. Blog de ChristianDvE (Beta). http://www.christiandve.com/2016/10/perfil-usuario-twitter-espana-resultados/

Dowling, J., & Pfeffer, J. (1975). Organizational Legitimacy: Social Values and Organizational Behavior. *The Pacific Sociological Review*, *18*(1), 122–136. https://doi.org/10.2307/1388226

Dumay, J., Guthrie, J., & Farneti, F. (2010). Gri Sustainability Reporting Guidelines For Public And Third Sector Organizations. *Public Management Review*, *12*(4), 531–548. https://doi.org/10.1080/14719037.2010.496266

Dutot, V., Lacalle Galvez, E., & Versailles, D. W. (2016). CSR communications strategies through social media and influence on e-reputation. *Management Decision*, *54*(2), 363–389. https://doi.org/10.1108/MD-01-2015-0015

Easman, E. S., Abernethy, K. E., & Godley, B. J. (2018). Assessing public awareness of marine environmental threats and conservation efforts. *Marine Policy*, *87*, 234–240.

https://doi.org/10.1016/j.marpol.2017.10.030

Echebarria, C., Barrutia, J. M., & Aguado, I. (2004). Local Agenda 21: Progress in Spain. *European Urban and Regional Studies*, *11*(3), 273–281. https://doi.org/10.1177/0969776404041490

Eom, S. J., Hwang, H., & Kim, J. H. (2018). Can social media increase government responsiveness? A case study of Seoul, Korea. *Government Information Quarterly*, *35*(1), 109–122. https://doi.org/10.1016/j.giq.2017.10.002

Etter, M. (2014). Broadcasting, reacting, engaging – three strategies for CSR communication in Twitter. *Journal of Communication Management*, *18*(4), 322–342. https://doi.org/10.1108/JCOM-01-2013-0007

Farneti, F., & Guthrie, J. (2009). Sustainability reporting by Australian public sector organisations: Why they report. *Accounting Forum*, *33*, 89–98. https://doi.org/10.1016/j.accfor.2009.04.002

Ferejohn, J. (1999). Accountability and Authority: Toward a Theory of Political Accountability. In A. Przeworski, S. C. Stokes, & B. Manin (Eds.), *Democracy, Accountability, and Representation* (pp. 131–153). Cambridge University Press. https://doi.org/10.1017/cbo9781139175104.005

Frickel, S., & Davidson, D. J. (2004). Building Environmental States: Legitimacy and Rationalization in Sustainability Governance. *International Sociology*, *19*(1), 89–110. https://doi.org/10.1177/0268580904040922

Frost, G. R., & Seamer, M. (2002). Adoption of Environmental Reporting and Management Practices: An Analysis of New South Wales Public Sector Entities. *Financial Accountability & Management*, *18*(2), 103–127. https://doi.org/10.1111/1468-0408.00147

Frost, J. (2019). *Regression Analysis: An Intuitive Guide for Using and Interpreting Linear Models.* (eBook). https://statisticsbyjim.com/regression/interpret-r-squared-regression/

Fundación Orange. (2014). *eEspaña 2014*. https://doi.org/ISSN 2174-3886

Fundación Telefónica. (2016). *La Sociedad de la Informacionen España 2015*. https://www.fundaciontelefonica.com/arte_cultura/publicaciones-listado/pagina-item-publicaciones/itempubli/483/

Gao, X., & Lee, J. (2017). E-government services and social media adoption: Experience of small local governments in Nebraska state. *Government Information Quarterly*, *34*(4), 627–634. https://doi.org/10.1016/j.giq.2017.09.005

García-Sánchez, I. M., Frías-Aceituno, J. V., & Rodríguez-Domínguez, L. (2013). Determinants of corporate social disclosure in Spanish local governments. *Journal of Cleaner Production*, *39*, 60–72. https://doi.org/10.1016/j.jclepro.2012.08.037

Gobierno de España. (2018). *PLAN DE ACCIÓN PARA LA IMPLEMENTACIÓN DE LA AGENDA 2030 Hacia una Estrategia Española de Desarrollo Sostenible*.

Gómez Bruna, D., & Martín Duque, C. (2019). Los impactos del turismo en España: diferencias entre destinos de sol y playa y destinos de interior. *Cuadernos de Turismo*, *43*(43), 325–347. https://doi.org/10.6018/turismo.43.13

Gray, R., Kouhy, R., & Lavers, S. (1995). Corporate social and environmental reporting. *Accounting, Auditing & Accountability Journal*, *8*(2), 47–77. https://doi.org/10.1108/09513579510146996

Greenpeace. (2019). *Análisis de los programas electorales de las elecciones generales del 28 de abril de 2019*. https://es.greenpeace.org/es/wp-content/uploads/sites/3/2019/04/Elecciones-Generales-28-4-19-Análisis-Greenpeace-1-1.pdf

GRI. (2019). *Global Reporting Initiative*. https://www.globalreporting.org/Pages/default.aspx

GRI Standards. (2018). *GRI Standards Download Center*. https://www.globalreporting.org/standards/gri-standards-download-center/

Guillamón, M. D., Bastida, F., & Benito, B. (2011). The determinants of local government's financial transparency. *Local Government Studies*, *37*(4), 391–406. https://doi.org/10.1080/03003930.2011.588704

Guillamón, M. D., Rios, A. M., & Vicente, C. O. (2011). Transparencia financiera de los municipios españoles. Utilidad y factores relacionados. In *Auditoría Pública* (Vol. 55).

Guthrie, J., Ball, A., & Farneti, F. (2010). Advancing Sustainable Management of Public and Not For Profit Organizations. *Public Management Review*, *12*(4), 449–459. https://doi.org/10.1080/14719037.2010.496254

Guthrie, J., & Farneti, F. (2008). GRI Sustainability Reporting by Australian Public Sector Organizations. *Public Money & Management*, *28*(6), 361–366. https://doi.org/10.1111/j.1467-9302.2008.00670.x

Haro-De-Rosario, A., Sáez-Martín, A., & Caba-Pérez, M. del C. (2018). Using social media to enhance citizen engagement with local government: Twitter or Facebook? *Sage*, *20*(1), 29–49. https://doi.org/10.1177/1461444816645652

Haro-de-Rosario, A., Sáez-Martín, A., & del Carmen Caba-Pérez, M. (2018). Using social media to enhance citizen engagement with local government: Twitter or Facebook? *New Media & Society*, *20*(1), 29–49. https://doi.org/10.1177/1461444816645652

Hernández de Cos, P. (2018). *La recuperación de la economía española. Evolución reciente y perspectivas del mercado inmobiliario*.

Hodges, H. E., & Stocking, G. (2016). A pipeline of tweets: environmental movements' use of Twitter in response to the Keystone XL pipeline. *Environmental Politics*, *25*(2), 223–247. https://doi.org/10.1080/09644016.2015.1105177

Honeycutt, C., & Herring, S. C. (2009). *Beyond Microblogging: Conversation and Collaboration via Twitter*. http://bitlib.org/twitter/index.php

INE, I. N. de E. (2017). *Estadísticas territoriales*. http://www.ine.es/FichasWeb/Welcome.do

Irizarry, R., & Love, M. (2017). *dplyr tutorial*. PH525x Series - Biomedical Data Science. http://genomicsclass.github.io/book/pages/dplyr_tutorial.html

Joseph, C., & Taplin, R. (2011). The measurement of sustainability disclosure: Abundance versus occurrence. *Accounting Forum*, *35*(1), 19–31. https://doi.org/10.1016/j.accfor.2010.11.002

Kelemen, R. D. (2010). Globalizing European Union environmental policy. *Journal of*

European Public Policy, *17*(3), 335–349. https://doi.org/10.1080/13501761003662065

Kelemen, R. D., & Vogel, D. (2010). Trading Places: The Role of the United States and the European Union in International Environmental Politics. *Comparative Political Studies*, *43*(4), 427–456. https://doi.org/10.1177/0010414009355265

Kim, E. (2015). A Comparative Study on Social Media Use and Public Participation in Korea and the United States: Does Social Media Matter? *The Korean Journal of Policy Studies*, *30*(1), 207–230. http://www.statisticbrain.com/facebook-statisti

Knee Tan, C., Ogawa, A., & Matsumura, T. (2008). Innovative climate change communication: team minus 6%. In *Global Environment Information Centre* . https://www.researchgate.net/publication/255756782_Innovative_climate_change_commu nication_team_minus_6

Kosajan, V., Chang, M., Xiong, X., Feng, Y., & Wang, S. (2018). The design and application of a government environmental information disclosure index in China. *Journal of Cleaner Production*, *202*, 1192–1201. https://doi.org/10.1016/j.jclepro.2018.08.056

KPMG International. (2017). *The KPMG Survey of Corporate Responsibility Reporting 2017*. www.kpmg.com/crreporting

Lamprinidi, S., & Kubo, N. (2008). Debate: The global reporting initiative and public agencies. In *Public Money and Management* (Vol. 28, Issue 6, pp. 326–329). https://doi.org/10.1111/j.1467-9302.2008.00663.x

Lapuente Giné, V. (2015, December 22). Elecciones 20D: Prometen y cumplen. *El Pais*. https://elpais.com/elpais/2015/12/21/opinion/1450697017_305624.html

Leeson, R., Ivers, J., & Dickinson, D. (2005). Sustainability reporting by the public sector: Momentum changes in the practice, uptake and form of reporting by public agencies. *Accountability Forum*, *8*(12–21).

Lerman, K., & Ghosh, R. (2010). *Information Contagion: an Empirical Study of the Spread of News on Digg and Twitter Social Networks*. https://networkchallenge.darpa.mil

Liu, X., & Anbumozhi, V. (2009). Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. *Journal of Cleaner Production*, *17*(6), 593–600. https://doi.org/10.1016/J.JCLEPRO.2008.10.001

Lodhia, S., Jacobs, K., & Park, Y. J. (2012). Driving Public Sector Environmental Reporting. *Public Management Review*, *14*(5), 631–647. https://doi.org/10.1080/14719037.2011.642565

Lodhia, S. k. (2004). Legitimacy motives for World Wide Web (WWW) environmental reporting: An exploratory study into present practices in the Australian minerals industry. *International Journal of Accounting and Finance*, *4*, 1–15. https://www.researchgate.net/publication/259803198_Legitimacy_motives_for_World_Wi de_Web_WWW_environmental_reporting_An_exploratory_study_into_present_practices _in_the_Australian_minerals_industry

Macotela, C., & Burman, A. (2016). *Social Media as a new Mass Media tool for environmen consciousness; Case study of social media campaign #Kohälsa by Skånemejerier.tal* [LUND University]. http://lup.lub.lu.se/student-papers/record/8892053

Marimon, F., Alonso-Almeida, M. del M., Rodríguez, M. del P., & Cortez Alejandro, K. A. (2012). The worldwide diffusion of the global reporting initiative: what is the point? *Journal of Cleaner Production*, *33*, 132–144. https://doi.org/10.1016/J.JCLEPRO.2012.04.017

Martín, J. M. M., Aguilera, J. D. D. J., & Moreno, V. M. (2014). Impacts of Seasonality on Environmental Sustainability in the Tourism Sector Based on Destination Type: An Application to Spain'S Andalusia Region. *Tourism Economics*, *20*(1), 123–142. https://doi.org/10.5367/te.2013.0256

McElroy, J., Bisman, J., & Mathews, R. (2005, November). A Study of Environmental Accounting within NSW Local Government. *7th Asian-Pacific Conference on International Accounting Issues*. https://researchers.mq.edu.au/en/publications/a-study-of-environmental-accounting-within-nsw-local-government

Mergel, I. (2013). Social media adoption and resulting tactics in the U.S. federal government. *Government Information Quarterly*, *30*(2), 123–130. https://doi.org/10.1016/J.GIQ.2012.12.004

Millham, M. H., & Atkin, D. (2018). Managing the virtual boundaries: Online social networks, disclosure, and privacy behaviors. *New Media & Society*, *20*(1), 50–67. https://doi.org/10.1177/1461444816654465

Mooney, P., Winstanley, A. C., & Corcoran, P. (2009). Evaluating Twitter for Use in Environmental Awareness Campaigns. *Political Science*. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.460.6120&rep=rep1&type=pdf

Moreno, A. (2010). *TURISMO Y CAMBIO CLIMÁTICO EN ESPAÑA Evaluación de la Vulnerabilidad del Turismo de Interior frente a los Impactos del Cambio Climático*. www.icis.unimaas.info

Navarro, A., Alcaraz, F. J., & Ortiz, D. (2010). The disclosure of corporate social responsibility information in public administratons: An empirical study in local governments. *Revista de Contabilidad-Spanish Accounting Review*, *13*(2), 285–314. https://doi.org/10.1016/S1138-4891(10)70019-4

Navarro, A., Ortiz, D., Alcaraz, francisco J., & Zafra, J. L. (2011). La divulgación de información sobre sostenibilidad en los gobiernos regionales y sus factores influyentes: el caso de España. *Paper Presented at 16st Congress AECA*.

Observatorio de la Sostenibilidad. (2018). *Ciudades Sostenibles en España*. www.observatoriosostenibilidad.com

Osborne, S. P., & Ball, A. (2011). *Social accounting and public management : accountability for the public good*. Routledge.

Oyero, O., Oyesomi, K., Abioye, T., Ajiboye, E., & Kayode-Adedeji, T. (2018). Strategic communication for climate change awareness and behavioural change in Ado-Odo/Ota local government of Ogun state. *Etude de La Population Africaine*, *32*(1), 4057–4067. https://doi.org/10.11564/32-1-1177

Patten, D. M. (1991). Exposure, legitimacy, and social disclosure. *Journal of Accounting and Public Policy*, *10*(4), 297–308. https://doi.org/10.1016/0278-4254(91)90003-3

Prado-Lorenzo, J. M., García-Sánchez, I. M., & Cuadrado-Ballesteros, B. (2012). Sustainable cities: Do political factors determine the quality of life? *Journal of Cleaner Production*,

21(1), 34–44. https://doi.org/10.1016/j.jclepro.2011.08.021

Quiroga, S. R. (2019). Políticas públicas, medioambiente y comunicación gubernamental : Public policies, environment and government communication. *Questión.* https://doi.org/10.24215/16696581e137

R Core Team. (2018). *R: A Language and Environment for Statistical Computing.* https://www.r-project.org/

Ramírez, R. R., & Palos-Sánchez, P. R. (2018). Environmental Firms' Better Attitude towards Nature in the Context of Corporate Compliance. *Sustainability*, *10*(9), 1–21. https://ideas.repec.org/a/gam/jsusta/v10y2018i9p3321-d170414.html

Reddick, C. G., & Norris, D. F. (2013). Social media adoption at the American grass roots: Web 2.0 or 1.5? *Government Information Quarterly*, *30*(4), 498–507. https://doi.org/10.1016/j.giq.2013.05.011

REDS. (2015). *Red Española de Desarrollo Sostenible.* https://reds-sdsn.es/quienes-somos/red-espanola-desarrollo-sostenible

Regional Environmental Center for Central and Eastern Europe. (2010). *What is a Sustainable City?* http://archive.rec.org/REC/Programs/SustainableCities/Regional.html

Ribeiro, V. (2007). *La gestión medioambiental en las entidades públicas locales portuguesas. Una perspectiva contable* [Universidade de Santiago de Compostela]. https://dialnet.unirioja.es/servlet/tesis?codigo=109108&info=resumen&idioma=SPA

Ribeiro, V., da Silva Monteiro, S. M., & de Abreu e Moura, A. M. (2016). *Determinants of Sustainability E-Reporting in Portuguese Municipalities: An Institutional and Legitimacy Theoretical Framework* (S. (Eds.). E. G. P. L. Crowther, D., Seifi (ed.); 10th ed., pp. 131–163). Corporate Responsibility and Stakeholding: Developments in Corporate Governance and Responsibility. https://doi.org/10.1108/S2043-052320160000010011

Ribeiro, V., & Guzman, C. (2011). La divulgación de información medioambiental en las autarquias portuguesas: caracterización y factores explicativos. *CONTABILIDADE & GESTÃO*, 43–76. https://www.occ.pt/fotos/editor2/contg11_web_low.pdf#page=39

Richardson, A. J. (1987). Accounting as a legitimating institution. *Accounting, Organizations and Society*, *12*(4), 341–355. https://doi.org/10.1016/0361-3682(87)90023-7

Roca, L. C., & Searcy, C. (2012). An analysis of indicators disclosed in corporate sustainability reports. *Journal of Cleaner Production*, *20*(1), 103–118. https://doi.org/10.1016/j.jclepro.2011.08.002

Rodríguez-Pina, G., & Mateo, J. J. (2017, August 31). Cómo funciona la limitación de mandatos donde ya existe. *El País.* https://elpais.com/politica/2017/08/30/actualidad/1504094126_368904.html

Sánchez de Miguel, A. (2019). *Ránking de la contaminación lumínica en España.* https://elpais.com/elpais/2019/03/27/ciencia/1553676066_630791.html

Sánchez, S. (2018). *Estadísticas redes sociales 2018 en España.* https://www.concepto05.com/2018/07/estadisticas-redes-sociales-2018-en-espana/

Schneider, K. (1997). Involuntary Unemployment and Environmental Policy: The Double

Dividend Hypothesis. *The Scandinavian Journal of Economics*, *99*(1), 45–59. https://doi.org/10.1111/1467-9442.00046

Serafeim, G. (2013). The Role of the Corporation in Society: An Alternative View and Opportunities for Future Research. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2270579

Shan, S., Peng, J., & Wei, Y. (2020). Environmental Sustainability assessment 2.0: The value of social media data for determining the emotional responses of people to river pollution—A case study of Weibo (Chinese Twitter). *Socio-Economic Planning Sciences*, 100868. https://doi.org/10.1016/j.seps.2020.100868

Sobaci, M. Z., & Karkin, N. (2013). The use of twitter by mayors in Turkey: Tweets for better public services? *Government Information Quarterly*, *30*(4), 417–425. https://doi.org/10.1016/j.giq.2013.05.014

Song, C., & Lee, J. (2016). Citizens Use of Social Media in Government, Perceived Transparency, and Trust in Government. *Public Performance and Management Review*, *39*(2), 430–453. https://doi.org/10.1080/15309576.2015.1108798

Spash, C. L. (2002). Informing and forming preferences in environmental valuation: Coral reef biodiversity. *Journal of Economic Psychology*, *23*(5), 665–687. https://doi.org/10.1016/S0167-4870(02)00123-X

Statistic. (2018). *Countries with most Twitter users 2018*. https://www.statista.com/statistics/242606/number-of-active-twitter-users-in-selected-countries/

Strangis, D. (2012). Gobiernos Locales y Cambio Climático: la implementación del Pacto de los Alcaldes-Estudio de caso en Italia y España. *Institut Universitari d'Estudis Europeus*, *35*. https://recercat.cat//handle/2072/203935

Suárez-Rico, Y., Gómez-Villegas, M., García-Benau, M., Suárez-Rico, Y. M., Gómez-Villegas, M., & García-Benau, M. A. (2018). Exploring Twitter for CSR Disclosure: Influence of CEO and Firm Characteristics in Latin American Companies. *Sustainability*, *10*(8), 2617. https://doi.org/10.3390/su10082617

Switzer, D. (2019). Citizen Partisanship, Local Government, and Environmental Policy Implementation. *Urban Affairs Review*, *55*(3), 675–702. https://doi.org/10.1177/1078087417722863

The Social Media Family. (2018). *IV Estudio sobre los usuarios de Facebook, Twitter e Instagram en España*. https://gallery.mailchimp.com/bd3a1bab6413b4386f39329a2/files/50f57c93-d1a2-40ae-b219-83f9f19e5041/Informe_RRSS_2018_The_Social_Media_Family.pdf?utm_source=Descarga+informe+RRSS+2018&utm_campaign=62be7aef5d-automation-descarga-informe-2018&utm_medium=emai

Tian, X. L., Guo, Q. G., Han, C., & Ahmad, N. (2016). Different extent of environmental information disclosure across chinese cities: Contributing factors and correlation with local pollution. *Global Environmental Change*, *39*, 244–257. https://doi.org/10.1016/j.gloenvcha.2016.05.014

We are social, & Hootsuite. (2020). *Digital 2020* . https://wearesocial.com/digital-2020

Wickham, H., Francois, R., Henry, L., & Muller, K. (2017). *dplyr: A Grammar of Data Manipulation*. https://cran.r-project.org/package=dplyr

WTTC. (2020). *Spain 2020 Annual research*.

Wu, H., Li, Y., Hao, Y., Ren, S., & Zhang, P. (2020). Environmental decentralization, local government competition, and regional green development: Evidence from China. *Science of the Total Environment*, *708*, 135085. https://doi.org/10.1016/j.scitotenv.2019.135085

Wukich, C., & Steinberg, A. (2013). Nonprofit and Public Sector Participation in Self-Organizing Information Networks: Twitter Hashtag and Trending Topic Use During Disasters. *Risk, Hazards & Crisis in Public Policy*, *4*(2), 83–109. https://doi.org/10.1002/rhc3.12036

Zacharias, C., & Poldi, F. (2018). *TWINT - Twitter Intelligence Tool* (Python). GitHub. https://github.com/twintproject/twint

Zahedi, S. (2008). Tourism impact on coastal environment. *WIT Transactions on the Built Environment*, *99*, 45–57. https://doi.org/10.2495/CENV080051

Zheng, S., Kahn, M. E., Sun, W., & Luo, D. (2014). Incentives for China's urban mayors to mitigate pollution externalities: The role of the central government and public environmentalism. *Regional Science and Urban Economics*, *47*(1), 61–71. https://doi.org/10.1016/j.regsciurbeco.2013.09.003

CONCLUSION

The three articles that make up this thesis have been published (or accepted for publication) in high-impact international academic journals such as G*overnment Information Quarterly* (Twitter as a tool for citizen engagement: An empirical study of the Andalusian municipalities, 2019; Citizen reactions to municipalities' Instagram communication, 2020) and *International Journal of Public Administration in the Digital Age* (Environmental disclosure as a tool for public sector legitimacy: A Twitter intelligence approach, 2020).

Each article corresponds to a chapter of the thesis with the aim of evidencing and supporting the main research question (RQ): How do Andalusian citizens use Twitter and Instagram to engage with their local governments and how do these satisfy the informative need demanded by citizens? Also, as each chapter can be treated as a separate unit of investigation, each of them contains its own questions.

The first chapter aims to provide answers to the following research questions: (1) Does the size of a municipality influence its citizen engagement on Twitter? (2) Does activity on Twitter influence citizen engagement? (3) Does the audience influence citizen engagement? (4) Does the type of media influence citizen engagement? (5) Does the type of content influence citizen participation?

The second chapter deals with the following research questions: (1) To what extent do municipalities use Instagram as a communication channel to interact with their citizens, and what motivates its use? (2) What variables affect the Instagram activity of municipalities? (3) What variables affect the citizen reactions on Instagram?

The third and final chapter aims to answer the following research questions: (1) How do local governments use Twitter to publicise environmental issues? (2) What are the factors influencing the environmental disclosure of local governments on Twitter?

Empirical findings

The empirical findings obtained from the study are specific to each chapter, so they are detailed in each of them. In this section the most relevant discoveries are synthesised in order to answer the research question posed.

In answer to the question regarding how the social media networks Twitter and Instagram are useful platforms that allow local governments to upload publications on matters of

interest and that allow citizens to be informed and interact with their governments, the results show that there are clearly substantial differences between the Twitter and Instagram accounts of the municipalities in terms of the number of publications (activity) and the number of followers (audience). The population number of each municipality is not a factor to consider because there is an absence of patterns or relationships between the population of the municipality and the levels of citizen engagement in both platforms.

Our results show how local governments prefer to have municipal corporate accounts on Twitter rather than on Instagram, despite the fact that less citizen engagements happen on Twitter (0.57) than on Instagram (21.25). Although the two social media networks have similarities, citizens relate to local governments in different ways depending on the network they use. This comparison is included in the following summary table of the findings (Table 1).

Findings	Twitter	Instagram
Local government	96.55%	58.62%
Engagement	0.57	21.25
Content + publications	Culture and city promotion	
Media + publications	Webs Link	Pic
Engagement-Activity	Negative relations	
Engagement-Population	No confirmed	
Engagement-Audience	Negative relations	No confirmed
Metric + Engagement	Retweets	Likes
Media + Engagement	Pic/Video (Retweet y Favourites)	Pic (Likes)
	Text (Replies)	Video (Comments)
Content + Engagement		City promotional and 'other' content (Likes)
	Sport (Retweet and Favourites)	
	Environmental (Replies)	Transport and public works (Comments)

Table 1. Comparative findings of Twitter (chapter 1) vs. Instagram (chapter 2)

It is worth mentioning that both social media networks show a negative relationship between activity and citizen engagement. This is due to the fact that social media algorithms impair the visibility of publications on accounts with little engagement. In addition, it was found that the type of content and medium used has an impact on citizen engagement. However, the results show that the demand of citizens and the supply of local governments in this regard on media (picture, video, etc.) used in a post by the municipality and content (what the post is about) are controversial, especially on Twitter where tweets with photos or videos are the preferred media for citizens while local governments are more inclined to publish tweets with web links.

Regarding the adoption of social media by local governments, it was found that it is the municipalities with the least public debt that adopt and use Instagram the most.

In relation to public debt, according to our results from Chapter 3, it is the municipalities with the highest budget surplus, as well as the municipalities with the largest number of sustainable engagement networks, hat report the most on environmental issues through Twitter.

Chapter 3 offers an overview of how Twitter is being used by local governments for outreach on environmental issues. According to our results, the use of Twitter as an environmental disclosure tool (TEDI[27]) is almost non-existent, despite its potential considering that it is demanded by citizens.

The levels of engagement both on Twitter and on Instagram and the TEDI obtained as results of the chapters of this thesis are represented in the Andalusian maps in Figure 2. Where the low level of the three indicators is shown on a logarithmic scale, having thus mostly municipalities coloured in shades of low levels.

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[27] TEDI (Twitter Environmental Disclosure Index) is an environmental disclosure index on Twitter prepared by the authors of this research.

Figure 2: Engagement on Twitter and Instagram, and TEDI in Andalusia

Colour by Engagement on Twitter

Colour by Engagement on Instagram

Colour by TEDI
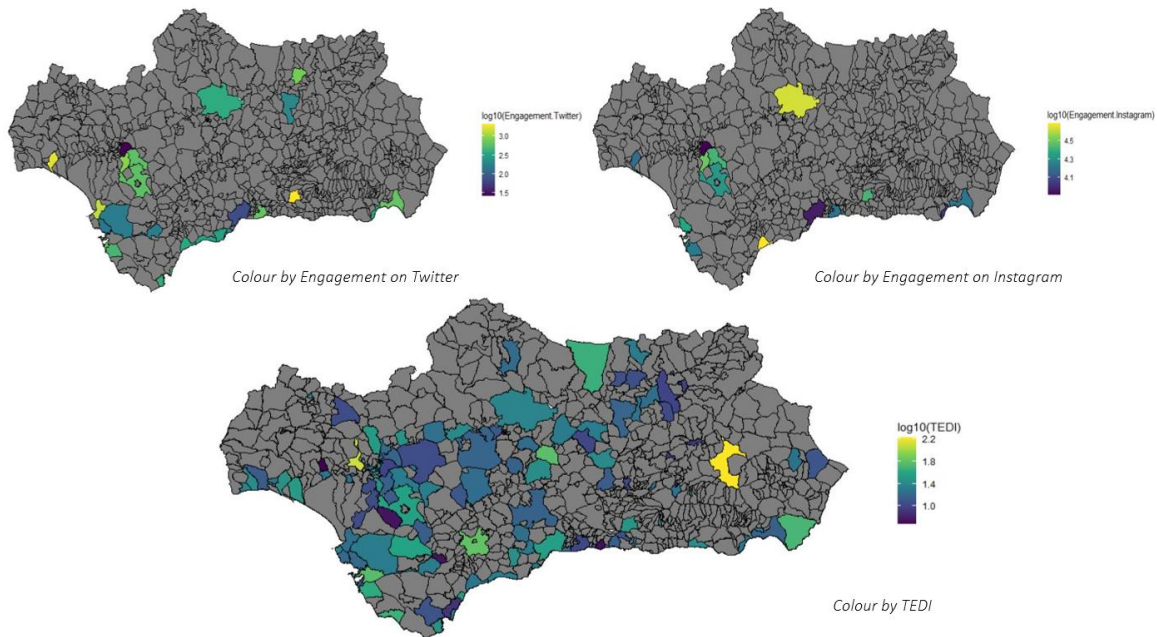
Implications

The contribution of this thesis is to provide a conceptual overview, by analysing citizen engagement of how Andalusian local governments use the Twitter and Instagram channels. Thus, the findings of this research could contribute significantly to the literature on the use of social media in public administration, especially in the field of engagement.

These findings can probably be the basis for building a Twitter and Instagram engagement model for municipalities, to explain the relationship between antecedent factors, the engagement that occurs, and the attitudinal and behavioural effects of users.

It should also be noted that in Chapter 2 a comparative table of the characteristics and functions of Facebook, Twitter, and Instagram has been made based on the previous literature (Table 1), which contributes significantly to the brief literature on the social network Instagram.

One of the study's most important contributions at a theoretical and practical level is the development in all chapters of keyword dictionaries to automatically classify publications according to their content. In particular, the creation in Chapter 3 of a dictionary of environmental keywords based on the standards of the sustainability reports of the Global Reporting Initiative (GRI 300) allowed us to develop a Twitter Environmental Disclosure Index (TEDI) that measures environmental dissemination on the social network Twitter.

Another important contribution for academics who research this subject is the presentation to the scientific community of the powerful methodology that we have applied, which allows us to carry out automatic and massive analyses. These methods range from applying OSINT tools with Twint and Instaloader to extract all the Twitter and Instagram posts respectively, to treating them later with open source software R. This methodological process is duly explained in the three chapters of the thesis, and illustrated in their figures to facilitate its compression (Figure 1, Chapter 1; Figures 1 and 2, Chapter 2; Figure 1, Chapter 3).

In this way, academics in this field are encouraged to conduct research following our methodology. As a result, works with findings closer to reality will proliferate, because researchers will be able to massively extract the information to be studied. Having more cases of empirical work at the municipal government level that are prepared with all the data and that allow new evaluations of the local dimensions will facilitate the generation of achievable strategies. For this reason, we believe that our findings can be useful to the 'community managers' of the municipalities when taking into account the factors that influence the engagement of citizens in their efforts to design successful online communication strategies.

Limitations and recommendation for future research

The contribution of this thesis is to provide a conceptual overview through citizen engagement of how Andalusian local governments use the Twitter and Instagram channels. In this way, the findings of this research could contribute significantly to the literature on social media in public administration, especially in the field of engagement.

These findings can probably be the basis for building a Twitter and Instagram engagement model for municipalities to explain the relationship between antecedent factors, the engagement that occurs, and the attitudinal and behavioural effects of users.

It should also be noted that in Chapter 2 a comparative table of the characteristics and functions between Facebook, Twitter and Instagram has been collected according to the previous literature (Table 1), which contributes significantly to the brief literature on the social network Instagram.

One of the most important contributions at a theoretical and practical level is the development in all chapters of key word dictionaries to automatically classify

publications according to their content. In particular, (Chapter 3) the creation of a dictionary of environmental keywords based on the standards of the sustainability reports of the Global Reporting Initiative (GRI 300), which allowed us to develop a Twitter Environmental Disclosure Index (TEDI) that measures environmental dissemination on the social network Twitter.

Another important contribution for the academics of this subject is to present the existence to the scientific community of the powerful methodology that we have applied, which allows us to carry out automatic and massive analyses. From applying OSINT tools with Twint and Instaloader to extract all the Twitter and Instagram posts respectively, to how to treat them later with open source software R. All this methodological process is duly explained in the three chapters of this thesis, and illustrated to facilitate its compression in their figures (Figure 1, Chapter 1; Figure 1 and 2, Chapter 2, Figure 1 Chapter 3).

In this way, academics in this field are encouraged to conduct research following this methodology. Thus, works with findings closer to reality will proliferate by being able to massively extract information to be studied. It turns out that having more cases of empirical work at the municipal government level that are prepared with all the data and allow new evaluations of the local dimensions, will facilitate the generation of achievable strategies. For this reason, we believe that the findings can be useful to the "community managers" of the municipalities when taking into account the factors that influence the engagement of citizens to design successful online communication strategies.

Conclusion

Social media are not only platforms for the general public or for companies, but also for public administrations, who adopt social media as a channel of communication and means of achieving transparency, especially in local governments, which are the organisations that make the greatest impact on the daily life of the population. It turns out that the current world is immersed in the 4.0 industrial revolution, with the digitisation of production processes. This shift towards digitisation is not exclusive to industry, as academic research also takes advantage of these advances. Therefore, we academics at the end of the second decade of the 21st Century must be consistent with the times we live in; we cannot conduct research without considering Big Data methodologies such as OSINT tools and techniques. These new technological advances have led to the opening of new avenues of research.

This study presents two main achievements (the two main objectives set out in the introduction section): first, the engagement of Andalusian citizens with their local governments is identified through analysis of social media; and second, once the way in which citizens interact is identified, how Andalusian local governments use social media to disseminate information that their citizens require of them is explored. To our knowledge, this is the first study to explore municipal communication and citizen participation through the Twitter and Instagram platforms by analysing all of the publications on those platforms.

It was found that despite the fact that both social media networks have high penetration rates, unfortunately citizen engagement of user was low. Having a corporate profile on a social network with many users does not mean that you will get an engaged audience. In general, there are indications that citizens' interest in informing themselves and in interacting with local governments is lacking.

This is a reality of which those responsible for communication in social media, the 'community managers' of local governments, seem not to be aware, because they publish without following effective strategies that would encourage engagement in their publications. This has been proven by these investigations, which show that on Twitter the tweets that generate the most citizen engagement deal with the environment, yet local governments ignore this topic and barely tweet about it.

That is why 'community managers' must know the findings presented in this thesis in order to design effective strategies to encourage citizen engagement. For example, it was detected that some types of media in publications provoke more engagement from citizen; thus, on Instagram, for a publication to be viral it must be accompanied by a photo, on the other hand, publications including videos seem to generate more debate.

In short, this study provides some evidence that local governments do not take full advantage of the potential of social media. Although they act successfully in some aspects, they are use social media more as a one-way communication channel than as a two-way communication channel, in that they publish information as an extension of traditional communication, directing readers to web pages, or else they use social media as a mere showcase of their municipality, adopting a 'poser' behaviour.

Returning to the question posed at the beginning of this study (RQ): How do Andalusian

citizens use Twitter and Instagram to engage with their local governments and how do these satisfy the informative need demanded by citizens? it is now possible to affirm that Andalusian local governments still have to learn to be more effective on social media. The intelligent use of these platforms such as Twitter or Instagram can be very useful for local governments due to their potential.

Some issues must be dealt with by local governments, so now the decision is up to them whether or not to dedicate effort to derive from this study some good practices and put them into operation in order to create a more active community by improving levels of citizen engagement, and thereby to create a more transparent and committed government. All of this would be a 'win-to-win' strategy in which both local governments and citizens benefit.