

# 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

**Huelva, 2021**



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PROGRAMA DE DOCTORADO

“CIENCIA REGIONAL: EMPRESA Y TERRITORIO”

Ph.D. DISSERTATION  
TESIS DOCTORAL



# **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

2021



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.



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## **RESUMEN y CONCLUSIONES** **en español**

El presente trabajo ha sido realizado en el grupo de investigación “Nuevas tecnologías en contabilidad y administración de empresas”, en la línea de investigación sobre nuevas tecnologías cuyo investigador principal es el doctor Enrique Bonsón Ponte, Catedrático del Departamento de Economía Financiera, Contabilidad y Dirección de Operaciones. Este grupo tiene sus orígenes en el año 1995 en la convocatoria del Plan Andaluz de Investigación, en la que se obtiene reconocimiento con el código SEJ 290. Esta tesis doctoral se ha desarrollado en el seno del proyecto UHU-1253498: *“Retos y oportunidades de las redes sociales en el ámbito empresarial y del sector público en Andalucía”* del Programa Operativo FEDER Andalucía 2014-2020.

## 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 (Şuşnea & 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<sup>1</sup> 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)<sup>2</sup> (Williams & Blum, 2018), un término que se remonta a la Segunda Guerra Mundial cuando EE. UU. emprendió el diseño de esta disciplina de inteligencia<sup>3</sup> como instrumento de apoyo a las decisiones y acciones de su gobierno (Burke, 2007;

---

<sup>1</sup> 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).

<sup>2</sup> 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).

<sup>3</sup> 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)<sup>4</sup>.

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

---

<sup>4</sup> 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 (Șuşnea & 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<sup>5</sup> (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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<sup>5</sup> 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”<sup>6</sup> 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 & Søre, 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<sup>7</sup>, 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<sup>8</sup> (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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<sup>6</sup> 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”.

<sup>7</sup> 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).

<sup>8</sup> *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  $N = \text{Todo}$  (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  $N < \text{Todo}$ . De todas formas, " $N = \text{Todo}$  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)<sup>9</sup> 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 GDPR (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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<sup>9</sup> 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<sup>10</sup> (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<sup>11</sup>

<sup>10</sup> 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 vínculo se aplica a las relaciones sólidas que brindan parentesco emocional, confianza y apoyo social (Putnam, 2000).

<sup>11</sup> Disponible en la página web [bit.ly/bcattools](https://bit.ly/bcattools)

de investigación de código abierto del respetado e innovador grupo de inteligencia de código abierto Bellingcat<sup>12</sup>.

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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<sup>12</sup> 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).

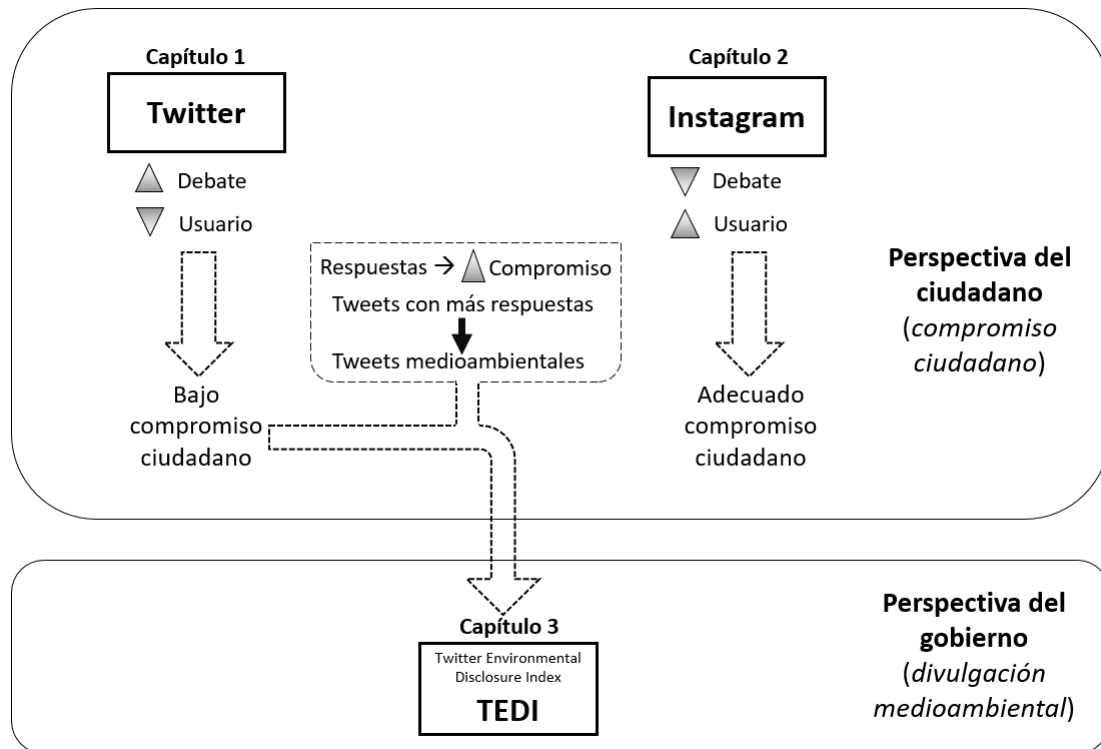


pregunta de investigación mediante la aplicación de estas teorías. El enfoque de combinar estas teorías ya se ha implantado en estudios anteriores (Bednárová, 2014; Ratkai, 2014), ya que no se consideran excluyentes entre sí, sino que se trata de teorías complementarias. Cada una de ellas va a ser explicada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

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

*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.

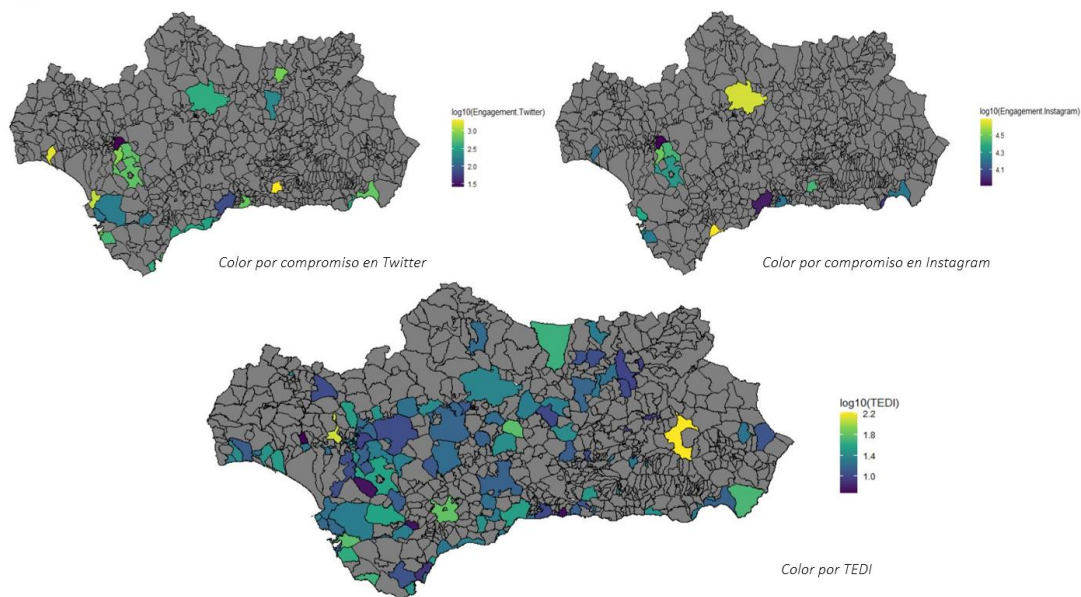
Respecto a la adopción de las redes sociales por parte de los gobiernos locales, se obtuvo que son los municipios con menor deuda pública los que adoptan y usan más activamente Instagram.

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<sup>13</sup>) 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*



<sup>13</sup> 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 Instaloder 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 comprensión 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 inmerso 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 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*<sup>14</sup>.

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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<sup>14</sup> 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**

This work has been carried out within the research group "New technologies in accounting and business administration", in the line of research on new technologies whose main researcher is Dr. Enrique Bonsón Ponte, Professor of the Department of Financial Economics, Accounting and Management of Operations. The research group has its origins in 1995 when (within the framework of the Andalusian Research Plan) it obtained its recognition with the SEJ290 code. This doctoral thesis has been developed within the project UHU-1253498: *“Retos y oportunidades de las redes sociales en el ámbito empresarial y del sector público en Andalucía”* of the FEDER Andalusia 2014-2020 Operational Program.

### 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 (Șuşnea & 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<sup>15</sup> 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)<sup>16</sup> (Williams & Blum, 2018). A term that dates back to World War II when the United States began to design this intelligence<sup>17</sup> 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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<sup>15</sup> *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).*

<sup>16</sup> *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).*

<sup>17</sup> *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)<sup>18</sup>.

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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<sup>18</sup> 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 (Şuşnea & 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<sup>19</sup> (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’<sup>20</sup> in the social media.

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<sup>19</sup> *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.*

<sup>20</sup> *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 & Søre, 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,<sup>21</sup> 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<sup>22</sup> (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’.*

<sup>21</sup> *‘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).*

<sup>22</sup> *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)<sup>23</sup> 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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<sup>23</sup> *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 GDPR (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<sup>24</sup> (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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<sup>24</sup> 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<sup>25</sup> from the respected and innovative open source intelligence group, Bellingcat<sup>26</sup>.

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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<sup>25</sup> Available at the website [bit.ly/bcattools](http://bit.ly/bcattools)

<sup>26</sup> 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).

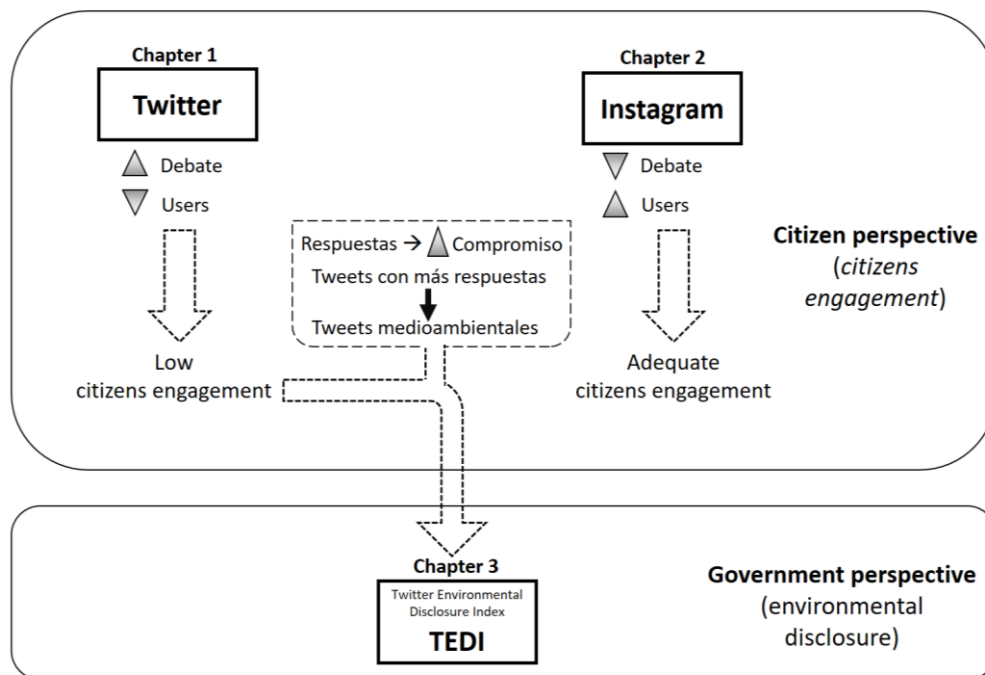
complementary theories. Each of them will be explained and detailed in the relevant section about theoretical foundations.

## 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.

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## **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; Zafiroopoulos, 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             | $(P2 / \text{number of followers}) * 1000$     |
| Commitment | C1             | Number of tweets commented / total tweets      |
|            | C2             | Total number of comments / total tweets        |
|            | C3             | $(C2 / \text{number of followers}) * 1000$     |
| Virality   | V1             | Number of tweets retweeted / total tweets      |
|            | V2             | Total number of retweets / total tweets        |
|            | V3             | $(V2 / \text{number of followers}) * 1000$     |
| 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.

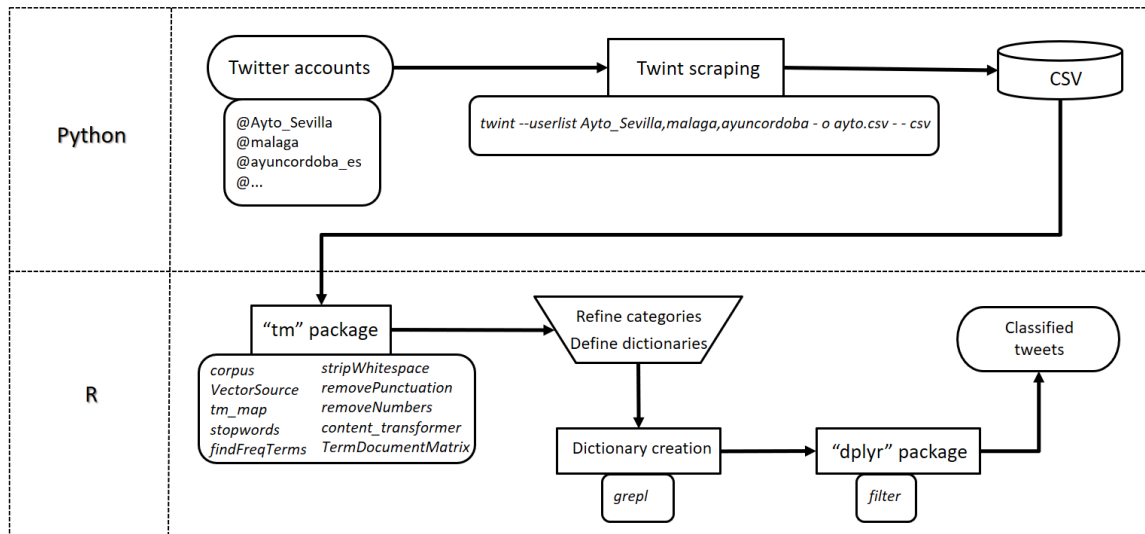
Sampling: The tweets were scraped together at the beginning of June 2018 using Twint.



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 |
|-----------------|---------|---------|---------|----------------|
| <b>Audience</b> | 149,040 | 16,746  | 1,500   | 36,430         |
| <b>Activity</b> | 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%).

| <b>Content type</b>        | <b>Percentage</b> |
|----------------------------|-------------------|
| 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%).

| <b>Media type</b>       | <b>Percentage</b> |
|-------------------------|-------------------|
| 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 favoured (P1), 10% (C1) were replied to, and 47% were retweeted (V1) by citizens. The average number of favoured 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 |
|------------|----------|------|---------|-------|----------------|
| Popularity | P1       | 0.74 | 0.379   | 0.15  | 0.14           |
|            | P2       | 6.69 | 1.672   | 0.19  | 1.62           |
|            | P3       | 1.26 | 0.262   | 0.01  | 0.28           |
| Commitment | C1       | 0.30 | 0.105   | 0.02  | 0.07           |
|            | C2       | 0.55 | 0.160   | 0.03  | 0.13           |
|            | C3       | 0.05 | 0.022   | 0.00  | 0.01           |
| Virality   | V1       | 0.72 | 0.470   | 0.23  | 0.14           |
|            | 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         |
|--------------------|---------------------------------------|------------------------|--------------|--------------------|
| Engagement         | Activity<br>(number of tweets)        | -0.716 **              | 0.000        | Negative relations |
|                    | Population<br>(number of inhabitants) | -0.285                 | 0.142        | No confirmed       |
|                    | Audience<br>(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.

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

| <b>Dependent variables</b> | <b>Independent variable</b> | <b>Method</b> | <b>Significance</b> |
|----------------------------|-----------------------------|---------------|---------------------|
| Favourites                 | Media Type                  | Welch's ANOVA | 0.00                |
| Replies                    |                             | 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.

| <b>Content Type</b>        |                       | <b>Number of Favourites</b> | <b>Number of Replies</b> | <b>Number of Retweets</b> |
|----------------------------|-----------------------|-----------------------------|--------------------------|---------------------------|
| Cultural and Marketing     | <i>Mean</i>           | 2.47                        | 0.20                     | 2.88                      |
|                            | <i>N</i>              | 273,771                     | 21,676                   | 318,693                   |
|                            | <i>Std. Deviation</i> | 11.04                       | 0.93                     | 10.15                     |
| Others                     | <i>Mean</i>           | 1.96                        | 0.23                     | 2.51                      |
|                            | <i>N</i>              | 209,695                     | 24,631                   | 268,511                   |
|                            | <i>Std. Deviation</i> | 6.88                        | 0.83                     | 7.67                      |
| Transport and Public works | <i>Mean</i>           | 0.75                        | 0.34                     | 0.97                      |
|                            | <i>N</i>              | 51,087                      | 22,937                   | 65,759                    |
|                            | <i>Std. Deviation</i> | 4.12                        | 0.74                     | 3.87                      |
| Security and Health        | <i>Mean</i>           | 0.99                        | 0.35                     | 1.22                      |
|                            | <i>N</i>              | 52,625                      | 18,416                   | 64,612                    |
|                            | <i>Std. Deviation</i> | 6.52                        | 0.76                     | 7.64                      |
| Employment and Education   | <i>Mean</i>           | 1.58                        | 0.19                     | 1.93                      |
|                            | <i>N</i>              | 75,062                      | 9,018                    | 91,854                    |
|                            | <i>Std. Deviation</i> | 4.16                        | 0.78                     | 5.81                      |
| Sport                      | <i>Mean</i>           | 2.50                        | 0.21                     | 2.91                      |
|                            | <i>N</i>              | 43,566                      | 3,648                    | 50,592                    |
|                            | <i>Std. Deviation</i> | 9.15                        | 0.89                     | 7.13                      |
| Environment                | <i>Mean</i>           | 1.77                        | 0.52                     | 1.76                      |
|                            | <i>N</i>              | 29,832                      | 8,710                    | 29,669                    |
|                            | <i>Std. Deviation</i> | 4.95                        | 1.31                     | 4.45                      |
| Total                      | <i>Mean</i>           | 1.75                        | 0.26                     | 2.12                      |
|                            | <i>N</i>              | 735,638                     | 109,036                  | 889,690                   |
|                            | <i>Std. Deviation</i> | 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          | Content category     | Welch's ANOVA | 0.00         |
| Replies             |                      | 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 of 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 tweeted.

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.

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**CHAPTER 2**

**CITIZEN REACTIONS TO  
MUNICIPALITIES' INSTAGRAM  
COMMUNICATION**

## Abstract

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 to understand the influence of media types (picture, video or album) used in a post by the municipality and content type (what the post is about).

Instaloader, an open source intelligence (OSINT) tool for Instagram, was applied. It allowed for automatically extracting all posts of the analysed municipalities (14,742 posts). They 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 present an account on Instagram, totalling 17 municipalities (58.62%), would be part of the final analysis.

Our findings demonstrate that there is no adoption and active use of Instagram when local governments have a high level of debt. We also found there to be an importance of quality over 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.

**Keywords:** Local Governments, Social Media, Instagram, Citizens Reactions, Media and Content Types

## 2.1. INTRODUCTION

Over the last decade, we have been witnessing an impressive growth of social media (SM) usage not only in private, but also in the public sector (Bonsón et al., 2015; Gruzd et al., 2018). Public administration bodies and, in particular, local governments have realised the benefits of SM use, including greater coverage, extended services and the possibility of obtaining feedback on governmental issues from citizens (Golbeck et al., 2010).

This paper addresses how municipalities use Instagram to engage with their citizens, because as a SM application, Instagram has not yet been widely examined in public administration literature. Although previous research (Bonsón & Bednárová, 2015; Cho et al., 2009) has shown that visual content is more engaging than simple text, so entities not only in the private but also the public sector are focusing on the visual SM trend, Instagram being a pioneer in this regard (Schmidbauer et al., 2018).

Instagram is an image- and video-based SM platform, whereby posts can include text-based captions with hashtags and comments (Gruzd et al., 2018) to support or express a message with the photo, album or video published. This research focuses on analysing Instagram because it is the fastest growing SM in active monthly users (Statista, 2019) and the third largest SM platform in the number of total users in the world, right behind Facebook and YouTube (We Are Social & Hootsuite's, 2019).

Instagram was initially created as a visual mobile-based application (McNely, 2012; Selva-Ruiz & Caro-Castaño, 2017; TreceBits, 2018). The growing popularity of this platform has been supported by the proliferation of smartphones, which allow the easy capture and sharing of images and videos (Towner & Muñoz, 2018). Recently, Instagram has extended its presence to computer desktops as well. However, in comparison to its peers such as Facebook and Twitter, which facilitate full access to all of their features from both desktop- and mobile-based apps, the functionality of Instagram is still more efficient on smartphones (Motyka, 2016).

Therefore, the benefits of mobile-based information exchange for civic and political engagement (Campbell & Kwak, 2010), together with the aforementioned attraction of visual content, makes Instagram an adequate SM to encourage citizen interactions.

Moreover, while other SM as Twitter is a more “formal” news platform that supports high levels of two-way communication between the government and citizens, Instagram

represents a more “informal” narrative concept that promotes clicktivist-type responses (Gruzd et al., 2018). Thus, in the current study, we analysed on Instagram the first level of the three that Mergel (2013b) identifies in the process of adoption of SM by local governments. This is the representation strategy, which through indicators such as likes and comments, and analysed citizens' reactions to it.

In this way, this study measures the impact of Instagram use by local governments (municipalities) in the region of Andalusia (Spain) on citizen reactions, as well as the effect of different media and content types on that reactions. In this paper, we therefore aim to answer the following research questions: (RQ1) To what extent do municipalities use Instagram as a communication channel to engage with their citizens and what motivates its use? (RQ2) What variables affect the Instagram activity of municipalities? (RQ3) What variables affect the citizen reactions on Instagram?

This research focuses on analysing the Instagram practices of the 29 main Andalusian municipalities. The importance of the chosen region lies in the fact that the use of Instagram will depend on the characteristics of the local community, since according to Friedland (2001), the local media systems maintain substantial autonomy. This region was chosen as the sample based on two factors: population and SM usage.

In the Europe, 65% of Europeans regularly use SM, while the Spanish average is even slightly higher at 68% (European Commission, 2018). In terms of Instagram, 33.4% of the total Spanish population are users of this platform (NapoleonCat, 2019). In addition, Spain has become one of the largest producers of Instagram Stories in the world, with a remarkable 150% more Story content than the global average (Krieger, 2017).

SM use in Spain is led by Andalusia (Fundación Orange, 2014; Fundación Telefónica, 2016) and three Andalusian cities – Seville, Granada and Malaga – are among the five Spanish cities with the highest number of profiles registered on SM by number of inhabitants (The Social Media Family, 2018). And It should be noted that Andalusia has set a world benchmark in mobile technology, since it has the largest 5G platform in Europe (Vodafone et al., 2019). And is that, Andalusia is a region characterized by seeking modernisation and change (Cruz Artacho & Acosta, 2014).

The Andalusian population represents 18% of the total Spanish population, making it the most populated region, and more than half of Andalusians reside in these 29



municipalities (INE, 2017).

For the purposes of our study, both quantitative and qualitative data were collected. Quantitative data in the analysis represent Instagram metrics (i.e. comments, likes) to measure the level of citizen reactions. Qualitative data, on the other hand, stem from identifying content and media types to understand the reactions. Previous research (Bonsón et al., 2019; Hernández Sampieri et al., 2010) has also pointed out the effectiveness of applying this type of mixed methodology. The rigorousness of the study is guaranteed by a robust analysis that considers all the municipalities' posts since they first joined Instagram.

This study provides a general overview of Instagram usage by Andalusian local governments and offers insights into the correlations related to municipality characteristics and Instagram metrics such as published posts, number of followers and the citizen reactions (i.e. comments, likes). It follows a similar approach and uses the same municipality sample to that of Bonsón et al. (2019) on Twitter. To the best of our knowledge, this is the first study to address this issue on Instagram, being this its main contribution. This study will therefore both fill a gap in the literature and may also help local governments integrate academic research into the municipality's communication strategy. As a result, this study might offer implications for both research and practice.

The rest of the article is organized as follows: section 2 presents a brief overview of previous studies related to the use of SM, and Instagram in particular, in the public sector and it present the variables to be study. Section 3 outlines the research methods. Section 4 presents the findings of this study, both regarding the Andalusian municipalities' usage behaviour of Instagram and the citizen reactions to their local governments on Instagram. The obtained findings are discussed in section 5, and the relevant conclusions are drawn in section 6. Finally, the main limitations and avenues for future research are discussed in section 7.

## **2.2. LITERATURE REVIEW**

The literature review covers three fundamental aspects: the use of social networks by municipalities, Instagram and the main explanatory variables to be used, to answer the research questions previously posed in the introduction section.

### **2.2.1. Municipalities' use of social media**

The report on e-governance in municipalities worldwide, carried out by Holzer and Manoharan (2019), which evaluated local governments on five categories (privacy and security, usability, content, services, and citizen engagement), concluded that citizen engagement recorded the lowest score among the five categories.

Therefore, the local governments must use more appropriately the tools that provide them with greater citizen engagement. With special attention to SM, since they have potential to provide support to citizens interacting with the public sphere (Eltantawy & Wiest, 2011). Several authors have indicated the relevance of SM as a key tool to encourage citizen engagement by facilitating for communication, discussion and coordination of public and social activities (Bonsón et al., 2017; Criado et al., 2013; Gil de Zúñiga et al., 2012; Marie Warren et al., 2014; Sáez Martín et al., 2015).

Although there are many SM platforms with different functionalities (Shane-Simpson et al., 2018), participation/engagement is a common characteristic in all of them, such as openness, conversation, connectivity and community (Chan-Olmsted et al., 2013; Mayfield, 2008; Zheng & Zheng, 2014).

The concept of “engagement” in the public sector is a broad term which implies both civic and political participation (Skoric et al., 2016). However, some previous research (Kaun & Uldam, 2018; Knowles, 2018; Park & Gil de Zúñiga, 2019) has independently analysed the concept of engagement as civic. Adler and Goggin (2005) have defined engagement as a citizen’s participation in community life with the objective of improving conditions for others or helping shape the future of the community. It is a key component, especially in local governments, for the optimal functioning of its governance (Siebers et al., 2019).

However, to achieve citizen engagement, a process must be followed. According to Mergel (2013b), the adoption of SM in local governments involves the following stages: 1) representation, 2) engagement and 3) networking. These three dimensions of social governance range from the lowest degree of online presence to more complex forms of networking (Mergel, 2016). Starting with the interaction, going through the feedback or contribution and reaching a dialogue (Nurmandi et al., 2018). Representation is considered a “push strategy” through which local governments merely disseminate information in order to increase the transparency of municipal issues. Engagement can be

described as a “pull strategy” that aims to increase the interaction between citizens and local government; tactics related to this strategy include calls to participate in opinion polls, requests for submission of ideas and comments, and invitations to co-create or co-design the content or services. The last stage of SM adoption in local governments, networking, is built on the interactive features of SM; it is used by government agencies to facilitate ongoing dialogue with citizens and to encourage them to share content on their networks.

As numerous previous studies (DePaula & Dincelli, 2016; Gesuele et al., 2016; Mergel, 2013b; Mossberger et al., 2013) have shown, representation is the strategy most adopted by local authorities. Because despite the fact that SM can be optimally operated as new local discussion forums (Haro-de-Rosario et al., 2018), the reality is that the citizen engagement with local governments in SM are rather limited, as SM are mostly used to inform citizens rather than to promote e-participation (Silva et al., 2019).

Therefore, efforts must be concentrated to promote engagement in SM with citizens, as citizens are considered to be the stakeholders of the municipalities. Nevertheless, “the stakeholders of the municipalities” is a broad term. Thus, we distinguish between primary, contractual or direct participants (politicians and citizens) and complementary, contextual or indirect participants (institutions, media, future generations...) (Melle Hernández, 2007; Moraga et al., 2014). Yet most of the stakeholders of the municipalities are citizens (Corrêa Gomes, 2004). Citizens, unlike individuals or groups in the private sector, do not voluntarily choose to be “clients” of the particular municipality, but that consideration such is automatically applied to them (Canel, 2014).

### **2.2.2. Instagram in literature**

We must emphasize, like other authors (Zolkepli et al., 2015), the importance of Instagram as an optimal tool to encourage citizens’ reactions. In the area of public administration, Gruzd et al. (2018) concluded that Instagram posts were more engaging in terms of number of likes and replies than Twitter posts.

Additionally, Instagram is gaining popularity among politicians faster than any other SM platform (Straus, 2018). The particular features of this SM meant that Instagram played a much more important role than Facebook in the Russian manipulation of US voters in the 2016 elections (Diresta et al., 2018). This indicates the relevance of Instagram as a

SM platform for interacting with citizens.

Academic studies on Instagram are quite scarce, in comparison to the abundant international academic research on the use of Facebook or Twitter. By examining the literature in Instagram, we have obtained several remarkable conclusions:

- i. Studies on the use of Instagram tend to focus more on aspects of user personality, leaving the scope of public administration unexplored (Alhabash & Ma, 2017; Choi & Sung, 2018; B. Kim & Kim, 2018; Lee et al., 2015; Moon et al., 2016; Paramboukis et al., 2016; Phua et al., 2017a, 2017b; Pittman & Reich, 2016; Sheldon & Bryant, 2016). It turns out that the Instagram literature is almost non-existent when focused on its use by governments, beyond studies related to the use of Instagram during political campaigns under the umbrella of political communication (Russmann & Svensson, 2017; Schmidbauer et al., 2018; Towner & Muñoz, 2018; Turnbull-Dugarte, 2019).

A research gap therefore exists concerning Instagram as a platform for citizen reactions, which in itself requires analysis that goes beyond the perception of the platform as a tool only for political campaigns. Previous studies indicate a gap in literature regarding the qualitative aspects of SM usage by local governments and the implications of this usage on government-to-citizen relationships (Bonsón et al., 2012; Norris & Reddick, 2013). By applying potent computing techniques together with the automated tools, we are able to study the phenomenon of citizen reactions, define its status-quo and explore it from a citizen's point of view.

- ii. The most common samples used in analyses of Instagram are composed of university individuals (Alhabash & Ma, 2017; Phua et al., 2017a, 2017b; Pittman & Reich, 2016; Sheldon & Bryant, 2016).

Despite the fact that the research will focus on young people since it is true that the use of Instagram varies according to age differences (Jang et al., 2015), it appears that gender is the best predictor to understand the use of Instagram (Sheldon & Bryant, 2016). Women between 18 and 30 years old are the most likely to be active on Instagram, and they are also the most common users on this platform (Djafarova & Rushworth, 2017; We are social & Hootsuite, 2020).

- iii. Previous literature has mainly investigated the cases of the United States and the

Canada (Alhabash & Ma, 2017; Gruzd et al., 2018; B. Kim & Kim, 2018; Lalancette & Raynauld, 2019; Phua et al., 2017a, 2017b; Pittman & Reich, 2016; Schmidbauer et al., 2018; Towner & Muñoz, 2018). Therefore, there is a lack of literature exploring this phenomenon in other regions, such as Europe.

There is a lack of research analysing citizen reactions on Instagram in regions other than the United States and Canada, which are the cases where the previous literature has mainly investigated. Other regions, such as Europe, still require exploration, which is one of the primarily motivators of our research. It must be taken into account that the latest trends show that the transformation in SM usage is no longer led by the United States, but rather that regions such as EMEA (Europe, Middle East and Africa) or Latin America are gaining importance (ReasonWhy, 2018). An opportunity thus emerges for academics and practitioners to redirect their attention and explore the practices of SM use in these new emerging regions and identify cultural patterns.

- iv. The number of comparative studies with other SM are in the majority as opposed to the exclusive research of Instagram (Blank & Lutz, 2017; Calderón et al., 2017; Jeri-Yabar et al., 2019; Krallman et al., 2016; Thelwall & Vis, 2017; Waterloo et al., 2018).

Every year, the marketing agency, We Are Social, and the SM management platform, Hootsuite, jointly publish a report on the evolution of the digital world; their latest report is Digital 2020. While they indicate that even though Facebook continues to be the most used SM network, highly-visual SM like Instagram and Snapchat have recently experienced a rise in popularity (Marengo et al., 2018), especially the short video platform TikTok (Anderson, 2020; Chen et al., 2019), all surpassing Twitter in monthly active users.

However, in academic publications Facebook and Twitter are still the most studied SM (Blank & Lutz, 2017). For this reason, when studying the case of Instagram, it is compared with both platforms. These three platforms, although they share similarities, have different characteristics and are designed for different purposes, which leads to different groups of users. In essence, people may use Facebook to stay in touch with friends, Twitter to follow news and trending topics, and Instagram to easily filter and upload visual images (Phua et al., 2017a). As Table 2.1 shows, there are differences and certain similarities of features and functions between Facebook, Twitter and Instagram.

| Features / Functions                      | Social media                                       |                                                                                                     |                                                                                          | References                                              |
|-------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                           | Facebook                                           | Twitter                                                                                             | Instagram                                                                                |                                                         |
| <i>FEATURES</i>                           |                                                    |                                                                                                     |                                                                                          |                                                         |
| <b>Platform base</b>                      | Text and image                                     | Text                                                                                                | Image                                                                                    | (Pittman & Reich, 2016)                                 |
| <b>Social Capital</b>                     | Bonding social capital (high)                      | Bridging social capital (very high)                                                                 | Bridging social capital (high)                                                           | (Phua, Jin, & Kim, 2017)                                |
| <b>Contact network</b>                    | To connect with ours real life friends and family. | To connect with people, we don't know in real life, including celebrities and other public figures. | To connect with others, we don't know in real life, but to a lesser degree than Twitter. |                                                         |
| <b>Profile pictures</b>                   | With other persons                                 | Not relevant                                                                                        | Selfie                                                                                   | (Thelwall & Vis, 2017)                                  |
| <b>Motivates users to hashtag</b>         | Amusing                                            | Organizing, Confirming, Trendgaging, Reaching                                                       | Organizing, Summarizing                                                                  | (Rauschnabel, Sheldon, & Herzfeldt, 2019)               |
| <b>Advertising</b>                        | Generate negative emotions                         |                                                                                                     | Generate entertainment compared to other platforms                                       | (Voorveld, van Noort, Muntinga, & Bronner, 2018)        |
| <b>Gender and age</b>                     | Adult male                                         | Young male                                                                                          | Young women                                                                              | (Shane-Simpson, Manago, Gaggi, & Gillespie-Lynch, 2018) |
| <b>Trusted</b>                            | Low                                                | Medium                                                                                              | High                                                                                     |                                                         |
| <i>FUNCTIONS</i>                          |                                                    |                                                                                                     |                                                                                          |                                                         |
| <b>Use motivations</b>                    | Convenience, Entertainment, Passing time           | Entertainment, Convenience, Medium appeal                                                           |                                                                                          | (Alhabash & Ma, 2017)                                   |
| <b>Social influence</b>                   | Weak                                               | Medium                                                                                              | Strong                                                                                   | (Arora, Bansal, Kandpal, Aswani, & Dwivedi, 2019)       |
| <b>Social commerce purchase intention</b> | Medium                                             | Low                                                                                                 | High                                                                                     | (Kircova, Yaman, & Köse, 2018)                          |
| <b>Expressing emotions</b>                | Neutral                                            | Negative                                                                                            | Positive                                                                                 | (Waterloo, Baumgartner, Peter, & Valkenburg, 2018)      |
| <b>Crisis communication</b>               | No effective                                       | Effective                                                                                           | No effective                                                                             | (Triantafillidou & Yannas, 2020)                        |

Table 2.1. Comparison in features and functions among main social media in the previous literature

One of the fundamental characteristics of these networks is the platforms on which they are based. Facebook is both image-based and text-based social media, while Twitter is only text-based and Instagram only is image-based (Pittman & Reich, 2016).

About the social capital from SM use, Phua and al. (2017b) concluded that Twitter users had the highest bridging social capital, followed by Instagram, while Facebook users had the high bonding social capital, preceded by Snapchat . The contact network of Facebook is more closed because its users connect with real life friends and family, while Twitter has a very open contact network because its users connect with people they do not know in real life, including celebrities and other public figures. Instagram has an open contact network because its users also connect with people, they do not know in real life but to a lesser degree than Twitter.

The profile picture of users on Twitter is not relevant, while on Facebook and Instagram it is but in different ways. On Facebook, accompanied photos predominate more and on Instagram, the selfies photos (Thelwall & Vis, 2017).

The use of hashtags also varies; hashtags are most used on Twitter, followed by Instagram and then Facebook, where most of the hashtags are usually private and not public as on Twitter and Instagram. The motivation for using hashtags on Twitter are for organising, confirming, trend gauging and reaching, while on Instagram, hashtags are used for organising and summarising and on Facebook, hashtags are used for amusement (Rauschnabel et al., 2019).

Advertising exists on all three platforms, but their presence does not have the same perception. While on Facebook and Twitter it generates negative emotions, on Instagram it generates entertainment compared to other platforms (Voorveld et al., 2018).

Finally, the users who use each SM platform the most are different and have different levels of trust in them (Shane-Simpson et al., 2018). Facebook generates low trust and its most active users are male adults. Twitter has medium levels of trust and young adults are its most active users. On Instagram, trust is high, and its primary users are young women.

The functions of the platforms mentioned are also diverse. Facebook is used first for convenience, then for entertainment, and then to pass the time, while Twitter and Instagram are used mainly for entertainment, then for convenience, and lastly for medium appeal (Alhabash & Ma, 2017). Regarding social influence, Instagram is the most influential SM platform, followed by Twitter and then Facebook (Arora et al., 2019). Instagram is also the platform that generates the most social commerce purchase

intentions, followed by Facebook and then Twitter (Kircova et al., 2018). Different emotions are usually expressed on each SM platform: neutral emotions on Facebook, negative emotions on Twitter and positive emotions on Instagram. During crisis situations, communication is not effective on Facebook or Instagram; it is only effective on Twitter (Triantafillidou & Yannas, 2020).

### **2.2.3. Literature on analytical framework variables**

This article aims to empirically identify the determinants of Instagram usage by Andalusian local governments, the determinants of activity in this channel and the determinants of citizen reactions.

To this end, two operational phases can be identified. The first phase will identify the possible determinants of the use and activity of Andalusian city governments on Instagram and the reactions of their citizen. The second operational phase concerns the assessment of the determinants previously identified that are structured around the characteristics of the municipality and the Instagram profile accounts. This second phase will be resolved throughout the paper.

The identification of possible determinants is based on the variables that academics have previously studied for each question posed. These are conceptually presented, together with their information source, in Table 2.2.

The use of Instagram (RQ1) is understood as the adoption and active presence on the platform; this data has been obtained by observing Instagram. The variables that have been identified to assess whether they affect to use are population, geolocation, political leanings' and public debt.

Activity (RQ2) is the number of posts made on each account; this data has been obtained from the Instagram profile of the municipalities. Population is the identified variable to assess.

Citizen reaction (RQ3) is engagement in the most basic SM adoption stage in local government, the "representation" dimension, which is indicated by likes and comments. Citizen reaction is calculated by the metric proposed by Bonsón and Ratkai (2013). Because of the extensive previous findings on it, the variables that have been identified to assess whether they affect it are population, activity, audience, media types and content types.



| Characteristics            | Concept             | Description                                                                                                                                                                                                          | Source                                                                                                                                                                                                             | Research Questions |
|----------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Municipality               | Geolocation         | The geographic location (coastal or inland) of the municipality.                                                                                                                                                     | Website of municipalities themselves                                                                                                                                                                               | RQ1                |
|                            | Political leanings' | The ideology (left-wing or right-wing) of the political party that governs in the municipality.                                                                                                                      |                                                                                                                                                                                                                    |                    |
|                            | Public debt         | Amount owed by a government that maintains with of individuals or other governments.                                                                                                                                 | Instituto de Estadística y Cartografía de Andalucía (IECA)                                                                                                                                                         |                    |
|                            | Population          | Number of inhabitants of each municipality.                                                                                                                                                                          |                                                                                                                                                                                                                    |                    |
| Instagram profile accounts | Activity            | Number of posts of each account.                                                                                                                                                                                     | Instagram profile of municipalities themselves                                                                                                                                                                     | RQ2, RQ3           |
|                            | Audience            | Number of followers of each account                                                                                                                                                                                  |                                                                                                                                                                                                                    | RQ3                |
|                            | Media type          | The way (multimedia content) in which the posts are published. There are three types: Picture, Album and Video.                                                                                                      | Instagram's own features                                                                                                                                                                                           |                    |
|                            | Content type        | The content that is disclosed in the posts. There are seven types: Cultural and Marketing, Transport and Public Works, Security and Health, Employment and Education, Sport, Environment, and Other. (see Table 2.4) | Based on Bonsón, Perea and Bednárová (2018), an adjustment of the list of other authors (Bonsón and Bednárová., 2015; Martí, Royo, and Acerete., 2012), which was preliminarily defined by Torres and Pina (2001). |                    |

*Table 2.2. Variables' definition and measurement*

Due to the limited literature that exists on Instagram in the public sphere, the identification of these variables has based on previous findings related to another SM. Therefore, we have tried to translate the previous findings from other SM to analyse whether the same thing occurs on Instagram, considering that personality traits moderate the influence of SM on discussion network heterogeneity and civic participation (Y. Kim et al., 2013),

and that each Internet user has an average of 5.54 SM accounts (Mander, 2015).

SM is increasingly playing an important role in promoting tourism (Madondo, 2016). Although, as some authors highlight, the most touristy municipalities recognise the added value of this promotion trend, their SM exploitation is still very limited and largely experimental (Hays et al., 2013; Perakakis et al., 2016), considering the main attraction of Andalusia for tourists is tourism known as "sun and beach" (Bruna & Duque, 2019). Moreover, in Andalusia, two out of every three tourist accommodations are concentrated on the coast (Junta de Andalucía, 2016). Previous studies show that the governments' geographic position may influence their adoption of SM (Metallo & Gesuele, 2016). Therefore, one of the variables chosen to explain the use of Instagram is the geolocation of the municipalities, which can be both coastal or inland.

The political ideology of the ruling party in the municipality may also generate an active presence on SM platforms (Bonsón et al., 2012). Some studies find that left-wing governments are more transparent than right-wing ones (García-Sánchez et al., 2013; Guillamón et al., 2011), so they may be more willing to use SM. In contrast, other studies have found that the use of Facebook by municipalities does not depend on whether the local governments were left- or right-wing (Guillamón et al., 2016). Therefore, political leaning is an additional variable to verify whether it affects the use of Instagram.

Previous studies demonstrate that governments' financial conditions may influence their adoption of SM (Criado et al., 2017). Some literature has studied the relationship between public debt and e-disclosure (Cárcaba & García-García, 2010). The literature suggests that higher public debt is associated with higher disclosure (Ingram & DeJong, 1987; Zimmerman, 1977), through different media, including SM. Therefore, governments with higher levels of debt make politicians disclose voluntary information on SM as a way of demonstrating their ability to face their obligations. However, the same does not happen in the case of Facebook, its use is lower when the level of local government debt is high (Guillamón et al., 2016). Thus, we propose public debt as one of variables for understanding the use of Instagram.

Several studies (Pina et al., 2009, 2010; Schedler & Summermatter, 2007) have pointed out that technological innovations such as e-government practices tend to be adopted more rapidly by larger local municipalities. The studies carried out by Bonsón et al. (2017) focusing particularly on SM usage by municipalities support the statement that

municipality size matters and that larger cities appear to have a greater likelihood of using SM as a communication channel with citizens. Moreover, the cost of preparing and disclosing information on SM are considered to be fixed, so that these costs become lower in larger municipalities, since they benefit from economies of scale (Guillamón et al., 2016). The number of inhabitants was chosen as one of the metrics for municipality size and was identified as one of variables for understanding the use of and activity on Instagram.

Nevertheless, a large number of inhabitants does not guarantee higher citizen engagement (Bonsón et al., 2017). Some authors postulate that this might be due to the sense of belonging, which is stronger in small municipalities where citizens feel more a part of the community, which in turn leads to higher reactions. This phenomenon is observed in SM interactions as well. Although, in larger municipalities people have less face-to-face contacts and use more web applications as communication tools (Guillamón et al., 2016). Thus, the population, as one of the metrics for municipality size, also was chosen as one of variables for understand citizen reactions.

Mergel (2013a) points out that if a public administration entity seeks to improve the level of reactions, it must constantly encourage citizens to actively participate on the municipality's SM platforms. Münchener Kreis (2013) and Zavattaro and Sementelli (2014) note that a one-way communication model does not boost interaction and does not lead to engaged citizens. Nevertheless, the recent evidence (Mergel, 2013a; Zafiroopoulos et al., 2014) shows that in public administration this model still persists.

Although Bonsón et al. (2017) did not find any relationship between the activity on the public administration SM account and citizen reactions, public sector use of the social platform Instagram has not yet been analysed. Given its specific feature – a visual content – the activity on this platform might lead to different outputs, as several studies (Cho et al., 2009; Davison, 2007) have found that visual content is more engaging. Thus, the municipalities' activity also was identified as one of variables to explain citizen reactions.

Some previous studies on SM and citizen reactions in the public sector found no relationship between audience size (number of followers) and citizen reactions (Bonsón et al., 2017; Ma, 2013). A pattern similar to the municipality's size might therefore be observed. Indeed, several authors have sought to explain this phenomenon by stating that greater reactions on SM with fewer followers is caused by individuals' perception that

their opinion is important, so they feel more encouraged to express themselves and communicate via these platforms (Ma, 2013). Therefore, understanding the number of followers of the account as the size of the audience was another variable of citizen reactions.

Instagram allows diverse visual content to be published. Its multimedia content is represented by four media types: picture, video, story or album (Facebook for developers, 2019). Previous studies have noted the significance of SM for information disclosure and argued that visual content is a more powerful communication tool that enhances the potency of a given message (Davison, 2007; Graves et al., 1996).

Media analysis of Facebook posts by local governments has been done by Bonsón et al. (2015) and Hofmann, Beverungen, Räckers, and Becker (2013), and both studies confirm that posts with pictures tend to increase the citizen interaction in terms of likes and comments, in comparison to plain text posts. Similar studies on Twitter (Zavattaro et al., 2015) have also claimed that messages with an additional layer of richness – such as images and photos – tend to draw a greater response from citizens. According to Bonsón and Bednárová (2018), the video format is a powerful medium because it combines sight, sound, motion and emotion to reach the senses of the audience. Considering the added layer of richness, the video medium provides in comparison to traditional tools, it may be more engaging than other media types. We therefore intention to explore whether different media types – depending on their degree of richness – led to different levels of citizen reactions on Instagram.

Previous research (Feroz Khan et al., 2014; Graham & Avery, 2013; Halpern & Katz, 2012) postulated that certain content type can generate higher/lower citizen reactions, however, there is no evidence on how it works on public sector Instagram accounts. Thus, for the purposes of our study, the content type has been classified into seven different categories (see methodology section). Furthermore, we aimed to find out whether there is a relationship between the number of likes and comments, which were considered proxies for citizen reactions, and the content type of the posts.

According to Hofmann et al. (2013), there is not any specific content type that would automatically lead to more engaged audience. Yet, several studies have found patterns according to which a particular content type such as cultural activities, sports, public transport or promotional publications for the city, region or country generated higher

levels of citizen participation (Bonsón et al., 2015; Bonsón & Bednárová, 2018). The final variable that we identified for the use of Instagram was content type.

## 2.3. METHODOLOGY

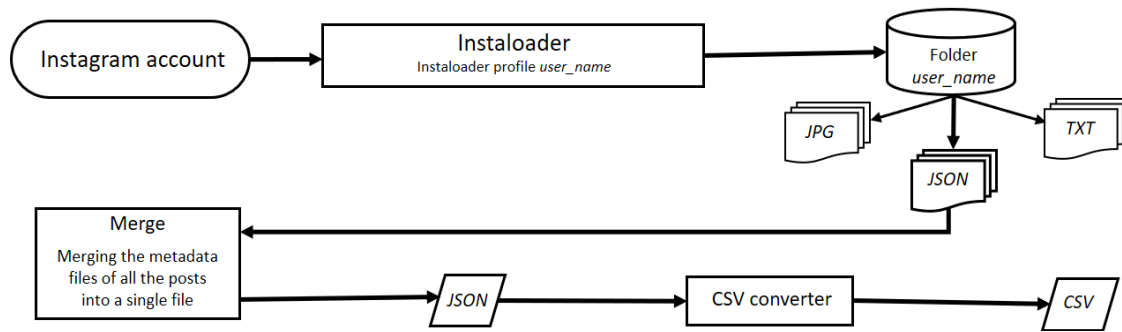
### 2.3.1. Sampling and Data Collection

Our sample consisted of the 29 largest Andalusian municipalities ranked by number of citizens based on the statistics published yearly by the *Instituto de Estadística y Cartografía de Andalucía* (IECA). These municipalities included those with a population exceeding 50,000 inhabitants. Andalusia has 785 municipalities, but the 29 municipalities chosen to represent more than 50% of the Andalusian population. For this reason, we have selected these municipalities as a sample for our analysis.

The data for further analysis were retrieved from the municipalities' verified Instagram accounts. The account information was collected by either following the Instagram icon link on the municipality's official website or by searching the Instagram platform to identify the verified municipality account. For the 29 municipalities, 17 verified Instagram accounts were identified. The period of analysis was from the moment they joined Instagram until August 31, 2018 and included all their posts on any local issue (sporting events, popular festivals, elections, etc.) until that date.

The data collection took place in September 2018 using Instaloader, a Python library for downloading pictures (or videos) along with their captions and other metadata from Instagram, which automated the collection process (Graf, 2017). When Instaloader runs to download the posts of an Instagram account, it returns a folder with the user's profile name as an output. This folder contains files for each post, including a JPG file for the image, a TXT file for the caption of each of the posts and a JSON file with the metadata. The latter were the raw material for our study.

Before starting the metadata analysis, data were processed to facilitate their further analysis. This was done by first merging all of the JSON files into a common file using Python and then using another Python code to convert the resulting single JSON file into a CSV file (Figure 2.1).

*Figure 2.1. Flowchart of data scraping*

After processing the data from the Instagram, the activity was measured by counting the total number of posts on each municipality Instagram account. Similarly, the number of followers was obtained to measure the audience. As shown in Table 2.3, citizen reactions were measured by using an adaptation of the Facebook metrics developed by Bonsón and Ratkai (2013) where only the metrics of popularity and commitment for the analysis of likes and comments respectively were considered. Both of these types of Instagram interactions are considered proxies for citizen reactions.

| Metrics    | Code | Calculation                                     |
|------------|------|-------------------------------------------------|
| Popularity | P1   | Number of posts liked / total posts             |
|            | P2   | Total number of likes / total posts             |
|            | P3   | $(P2 / \text{number of followers}) \times 1000$ |
| Commitment | C1   | Number of posts commented / total posts         |
|            | C2   | Total number of comments / total posts          |
|            | C3   | $(C2 / \text{number of followers}) \times 1000$ |
| Reactions  | R    | $P3 + C3$                                       |

*Table 2.3. Metrics for citizen reactions (Bonsón y Ratkai, 2013)*

The virality metric cannot be used due to Instagram's own characteristics. Unlike Facebook, with its "share" button and Twitter with "retweet", reposting is not an official feature of Instagram. The button "reposts" or "regram" to share a picture from another Instagram user with your followers is not available on the platform. Although it is true that the application allows you to repost publications on Instagram Stories, it is not possible to do so in the platform's feed (Molina, 2019). For this you need to use an external app or to take a screenshot of the original photo and republish it manually, always citing the original user (Romero, 2018). Some of these ways are not instantaneous as they are on Facebook and Twitter. None of the ways in which the repost/regram are performed leaves a record of how many times a post has been shared.

### 2.3.2. Content Analysis

This study also sought to identify whether content category and media type led to higher citizen reactions. The media types were identified using the ‘type’ column from the database; if this contained the term ‘GraphImage’, the post is a picture; if it contained the term ‘GraphVideo’, the post is a video; and if it contained the term ‘GraphSidecar’, the post is an album. We only classified and coded according to these three categories of media type on Instagram (picture, video and album), because the story category was discarded as it disappears after 24 hours, unless it is added as a highlight (Instagram Help Center, 2019), from which our Instagram scraping tool is not yet able to get metadata.

Holsti (1969) defines content analysis as a multipurpose research method which helps to investigate a wide spectrum of problems where specific characteristic of messages is being systematically and objectively identified. Numerous studies on SM (Bonsón & Bednárová, 2018; Martí et al., 2012; Torres & Pina, 2001) have applied content analysis to compare and analyses published content. Seven categories were used for coding.

This classification of content types is based on local service lists developed by Torres and Pina (2001) and later adapted by Martí, Royo, and Acerete (2012) and Bonsón et al. (2015). Bonsón et al. (2019) refined the classification framework according to the most frequent words that appear in the posts. Hence, some categories have been omitted or merged with another category.

For example, “public transport” and “public works and town planning” were merged into the common category “Transport and Public Works”, because they share many related keywords. The same happens with “education” and “employment and training schemes”, which were added into “Employment and Education”, and with “citizen protection and security” and “health” that moved to “Security and Health”.

In contrast, the “Environment” content remained an individual category due to its importance, and the “cultural and sports activities” content was separated into two categories due to its individual relevance, creating the “Sport” category on the one hand and “Cultural and Marketing” on the other. The “cultural” content and the “marketing/city promotion/tourism” were grouped into one category, because it was very difficult to differentiate both categories, as many of the cultural events are also tourist attractions, and most of the city promotion occurs through monuments or local festivities.

Finally, the content types that have barely been mentioned in Instagram posts of local municipalities, such as “attention to the citizen”, “social services”, “housing”, “governance issues”, “financial reporting”, “atmospheric information”, and “landscape”, among others, have been catalogued as “other” content type.

Table 2.4 shows the content types that were identified and coded for the post content analysis.

| Content type               | Post 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 services.                                                                                                                | 3    |
| Employment and Education   | Employment and training schemes. Education.                                                                                                                      | 4    |
| Sport                      | Sporting activities and events.                                                                                                                                  | 5    |
| Environment                | Environmental concern. Public cleaning services.                                                                                                                 | 6    |
| Other                      | Minority contents: attention to the citizen, social services, housing, governance issues, financial reporting, atmospheric information, landscape, among others. | 7    |

*Table 2.4. Content types*

For the purposes of this study, the whole process of content analysis consisted of four steps (as shown in Figure 2.1 and Figure 2.2): (1) sampling, (2) coding, (3) content analysing and (4) consolidating the results.

**Sampling:** In total, we analysed 14,742 posts, which represented 100% of the total posts published by the studied municipalities from the time they joined Instagram until August 2018.

**Coding:** Firstly, the preliminary categories of the content type were defined based on the Torres and Pina (2001) list which was later adjusted by other authors (Bonsón et al., 2015; Martí et al., 2012). Secondly, in the same way that Bonsón et al. (2019), the list was adapted based on the most frequent words identified in the posts of the local governments

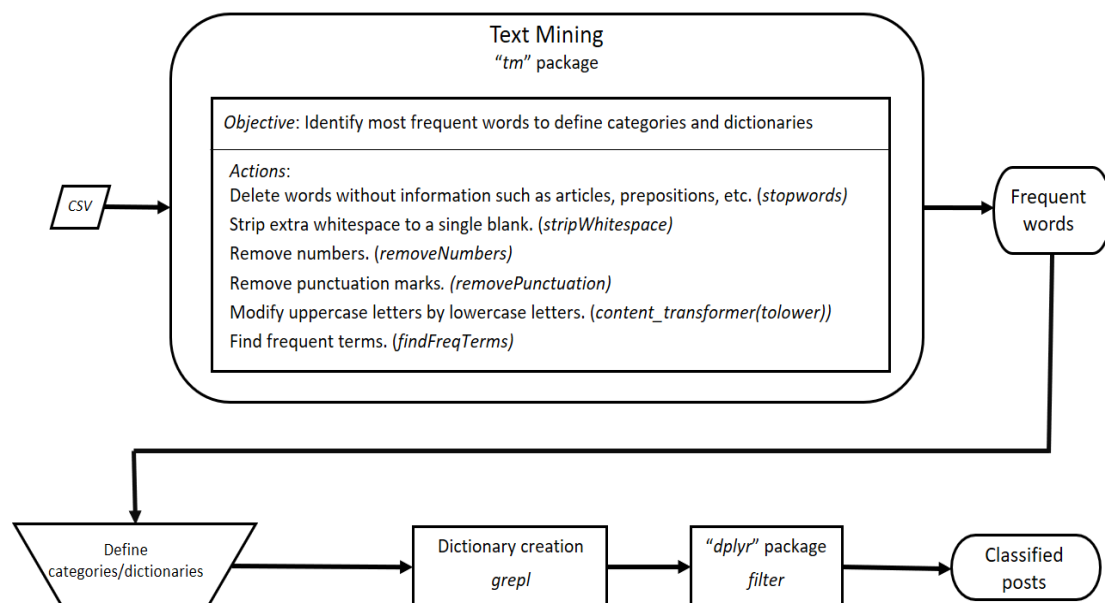


by using the R library “tm” (Feinerer et al., 2017). We used various function to transform the posts and find the most frequent words they contain (Figure 2.2). The content types for frequent words were catalogued, associated, and modified when needed. At this stage, the content of the posts was automatically tabulated based on the categories presented in Table 2.4. In addition, a dictionary was created for each category using the words appearing most frequently for that category (Figure 2.2); the dictionary contained the words that identify each type of content. The creation of the dictionaries used a function of the base package of R, *grepl* (R Core Team, 2018). At this point, the areas of possible ambiguity were identified together with any necessary adjustments in terms of classification descriptions and categorization of frequent words. The subjectivity was reduced due to the automated process of classification. Yet, if a post belongs to more than one category, an overlap bias might have occurred. All the adjustments were integrated into the content analysis framework to establish the final coding.

Content analysis: The R library “dplyr” (Wickham et al., 2017) has been used to automatically analyse and classify the content of the posts as shown in Figure 2.2.

Results consolidation: In this step, the results from the content analysis were consolidated and the statistical differences were calculated.

Figure 2.2. Flowchart of content analysis



### 2.3.3. Measurement of Variables

The selection analysed variables is based on some variables studied by Guillamón and al. (2016) for RQ1 and on both the variables studied by Bonsón, Bednárová, and Wei (2016), and Bonsón et al. (2019) for RQ2 and RQ3.

For RQ1, the dependent variable is the adoption and use of Instagram by municipalities, which we measured with dummy variables (0 = without an active presence on Instagram and 1 = with an active presence on Instagram). The independent variables are the geographic location of each municipality (geolocation), which we measured with dummy variables (0 = inland and 1 = coastal), the ideology of political party that governs the municipality (political leanings'), which we measured with dummy variables (0 = right-wing and 1 = left-wing), the amount owed by the government that maintains with individuals or other governments (public debt) and the number of inhabitants of each municipality (population). With these variables, we seek to explain the presence and active use of Instagram by municipalities.

For RQ2, the dependent variable is the municipality's activity on Instagram, that is, the number of posts published by each account. Its independent variable in this analysis is the number of inhabitants of each municipality (population). On RQ3, the dependent variable, the level of citizens' reactions against Instagram posts published by their municipalities, is measured by an adaptation of the metrics proposed by Bonsón and Ratkai (2013), obtaining a percentage for each municipality as a result.

Its independent variables in this study are both characteristics of the municipality and characteristics of the accounts of Instagram profiles, mainly to check whether there is a relationship with the level of reactions of citizens. Data about the number of inhabitants of each municipality (Population), the number of posts published by each account on Instagram (Activity), the number of followers (Audience) and the different media types and content types were collected. By these variables, we seek to explain the level of citizen reactions on Instagram.

### 2.3.4. Statistical Tests

After data collection, calculation of the citizens' reactions and identification of the media type and content type of each post, the analysis was carried out using the R software, both for descriptive analysis and to provide statistical measurements through, a generalized

linear model (Binomial), the rank correlation (Spearman's rank correlation coefficient), the Multiple linear regression, the proportions of F (Welch's ANOVA) and Independence test.

The descriptive statistics, which include the maximum, minimum, mean, standard deviation and the percentage, were provided to characterize the sample and to describe the characteristics of Instagram profiles each municipality.

The first research question employs the binomial generalised linear model to identify what determines the adoption and active use of Instagram by local governments. The dependent variable for this question is the use of Instagram and the independent variables are the characteristics of municipalities: geolocation (coastal vs. inland), political leanings' (left-wing vs. right-wing), public debt and population (number of inhabitants). The objects of analysis are the municipalities. In this case, the initial sample consisted of 29 municipalities, and we determined whether they had an Instagram account. The binomial generalised linear model was applied since the dependent variable is the number of yes/no occurrences, where the response data, Y, is binary (taking on only values 0 and 1). This model is as follows:

$$\text{Instagram's use} = \alpha + \beta_1 \text{Geolocation} + \beta_2 \text{Political Lean} + \beta_3 \text{Public debt} + \beta_4 \text{Population} + \epsilon$$

The second research question and part of the last employ a relationship analysis based on Spearman's correlation. The dependent variable for RQ2 is the activity of the accounts and the independent variable population of the municipality. For part of RQ3, the dependent variable is citizen commitment and the independent variables are population on the one hand, activity, on the other, and audience on the other hand. The objects of analysis of these research questions are the municipalities. The final sample consists of the 17 municipalities, that they are who have an Instagram's profile. A non-parametric correlation test was applied due to a non-normal distribution of the sample. The normality of the sample of the municipalities was checked by applying the Shapiro-Wilk Test, where a very low level of significance was detected ( $p \leq 0.05$ ); therefore, the sample follows a non-normal distribution.

However, to support the claim that activity and audience are negatively significant with

respect to citizen reactions, a multiple linear regression was used where both activity and audience will be analysed together; therefore, by using more than one explanatory variable, there will be more information in the construction of the model and, consequently, more accurate estimates (Rojo, 2007). The adequacy of this model is correct, given that the residuals are normal and that this is a homoscedastic model. The normality of the residuals was verified by applying the Shapiro–Wilk test, where a high level of significance was detected ( $p > 0.05$ ); therefore, the residuals follow a normal distribution. The variances remain constant (homoscedasticity) since the score test for non-constant error variance was applied and a high level of significance was detected ( $p > 0.05$ ). This model is as follows:

$$\text{Citizen reactions} = \beta_0 + \beta_1 \text{Activity} + \beta_2 \text{Audience} + \epsilon$$

For the RQ3 research question, studied also the media type and content type. An analysis of variance with Welch's correction (Welch's ANOVA) was conducted. The dependent variables in this model were the citizen reactions (likes and comments) and the independent variables were, on the one hand, the media type, and, on the other hand, the content type. In this case, the objects of analysis were the posts where the final sample consisted of 14,742 items. As it was previously detected that the sample failed to meet both normality and the homogeneity of the variance assumptions, Welch's ANOVA was applied. The normality of the sample of the reactions (likes and comments) was tested by applying the Jarque-Bera Test. As it was a large sample where a very low level of significance was obtained ( $p \leq 0.01$ ), the sample follows a non-normal distribution. To test the homogeneity of the variances, both the Levene Test and the Bartlett Test were applied, where again, a very low level of significance was obtained ( $p \leq 0.01$ ), which implies that at least one of the groups (the different media or content types) has a different variance. Therefore, the condition of homoscedasticity was not met, which means that it is a heteroscedastic sample. Thus, the option of using a nonparametric alternative, the Kruskal-Wallis test, was rejected, as one of its conditions is that the data are homogeneous in their variance. Thus, a non-paralytic heteroscedastic test, Welch's ANOVA, was applied (Keselman et al., 1979; Kuzhabekova, 2011).

Lastly, for media types and content types, a permutation independence test was used to find out whether there are significant differences in citizen reactions (comments and likes) among different types of media or content. The permutation test of independence, for one-

way data with an ordinal dependent variable, covers the designs used with the Mann–Whitney test, the Kruskal–Wallis test, the two-sample t-test, one-way ANOVA, one-way ANOVA with blocks, and ordinal regression equivalents (Mangiafico, 2016)

As the independence test is significant, a post-hoc analysis was performed to determine which media types or content types differ from other types among citizen reactions (comments and likes) through pairwise permutation tests. Because this analysis produces multiple p-values, adjustments to the p-values were made to avoid inflating the possibility of making a type-I error (Mangiafico, 2016). In its output, types sharing the same letter are not significantly different.

## 2.4. RESULTS

Before presenting the results, Table 2.5 is presented with the main metrics of the Instagram accounts of the 17 municipalities analysed to make it easier to follow the results obtained from the research questions presented below.

| <b>Municipalities</b>    | <b>Population</b> | <b>Audience</b> | <b>Penetration</b> | <b>Activity</b> | <b>Daily activity</b> | <b>Citizen reactions</b> |
|--------------------------|-------------------|-----------------|--------------------|-----------------|-----------------------|--------------------------|
| Estepona                 | 66863             | 1304            | 1.95%              | 91              | 0.07                  | 48.62                    |
| Córdoba                  | 325916            | 1317            | 0.40%              | 92              | 0.61                  | 42.97                    |
| Dos Hermanas             | 132551            | 273             | 0.21%              | 33              | 0.02                  | 31.52                    |
| Granada                  | 232770            | 1508            | 0.65%              | 227             | 1.14                  | 26.55                    |
| Alcalá de Guadaíra       | 75106             | 1140            | 1.52%              | 126             | 0.56                  | 26.29                    |
| El Puerto de Santa María | 88430             | 7456            | 8.43%              | 1251            | 0.61                  | 23.67                    |
| Utrera                   | 52701             | 2819            | 5.35%              | 697             | 0.64                  | 20.92                    |
| San Fernando             | 95643             | 1700            | 1.78%              | 480             | 0.73                  | 17.92                    |
| Chiclana de la Frontera  | 83148             | 968             | 1.16%              | 837             | 3.79                  | 16.92                    |
| Almería                  | 195389            | 4254            | 2.18%              | 2409            | 4.04                  | 16.47                    |
| Vélez-Málaga             | 79878             | 1335            | 1.67%              | 124             | 0.09                  | 16.26                    |
| Torremolinos             | 67701             | 2405            | 3.55%              | 1088            | 0.83                  | 15.68                    |
| Huelva                   | 145115            | 1403            | 0.97%              | 815             | 1.25                  | 15.5                     |
| Fuengirola               | 74929             | 3811            | 5.09%              | 1397            | 0.82                  | 13.86                    |
| Roquetas de Mar          | 93363             | 2532            | 2.71%              | 1087            | 0.65                  | 10.74                    |
| Málaga                   | 569002            | 9630            | 1.69%              | 964             | 0.53                  | 9.2                      |
| Sevilla                  | 689434            | 24978           | 3.62%              | 3026            | 1.27                  | 8.1                      |

*Table 2.5. Metrics of Instagram by each municipality ordered by citizen reactions*

#### 2.4.1. Descriptive Statistics of research question about Instagram's use

*RQ1: To what extent do municipalities use Instagram as a communication channel to engage with their citizens and what motivates its use?*

Of the 29 largest Andalusian municipalities listed in IECA in 2017, 58.62% (17/29) used Instagram as a channel of communication. In other words, from our sample, 17 municipalities have an active presence on Instagram, while 12 municipalities have not yet adopted Instagram as a communication platform for their government.

Table 2.6 records the analysis of the variables to identify which variables explain the presence and active use of Instagram by municipalities. Where it has been obtained that the only variable that is related to the use of Instagram is the public debt of the municipalities, that is a significant negative relationship. The other variables, the population, geolocation and political leanings', do not have any significant relationship to explain this case.

| Independent variable                      | Dependent variable |            |         |         |
|-------------------------------------------|--------------------|------------|---------|---------|
|                                           | Instagram's use    |            |         |         |
|                                           | Estimate           | Std. Error | Z value | Sig.    |
| (Intercept)                               | 2.652E-01          | 1.991E+00  | 0.133   | 0.8940  |
| Geolocation (coastal vs. inland)          | -3.214E-01         | 1.170E+00  | -0.275  | 0.7835  |
| Political sign (left-wing vs. right-wing) | -2.971E-02         | 1.071E+00  | -0.028  | 0.9779  |
| Public debt                               | -1.369E-02         | 6.611E-04  | -2.071  | 0.0383* |
| Population (number of inhabitants)        | 1.310E-05          | 1.182E-05  | 1.109   | 0.2675  |

\* Significant at  $p < 0.05$  (2-tailed)

*Table 2.6. Instagram's use. Multivariate statistics – Generalised Linear Model (Binomial)*

As for the total number of inhabitants (population), the numbers 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 level of citizens' reactions, there were evident differences among the municipalities analysed (Table 2.7). The municipality with the most inhabitants has a population of 689,434 citizens, while the smallest has only 52,701 (average = 180,467; std. = 184,508). The account with the largest audience had 24,978 followers, while the account with the smallest audience had only 273 followers (average = 5,608; std. = 19,066). Similarly, the largest penetration was 8.43%, while the lowest was as scant as 0.21% (average = 2.53%; std. = 2.13%). The differences were also present in the level of Instagram activity, where

the most active Instagram account had published 3,026 posts and the least active only 33 posts (average = 867; std. = 835). Regarding frequency of posting, the most active account per business day published six daily posts, while the least active published only 0.03 messages per day (average = 1, std. = 1.59). Citizens' reactions ranged from 8.10% to 48.62% (average = 21.24%, std. = 11.21%).

|                    | Maximum | Average | Minimum | Std. Deviation |
|--------------------|---------|---------|---------|----------------|
| Population         | 689,434 | 180,467 | 52,701  | 184,508        |
| Audience           | 24,978  | 4,049   | 273     | 5,921          |
| Penetration        | 8.43%   | 2.53%   | 0.21%   | 2.13%          |
| Activity Total     | 3,026   | 867     | 33      | 835            |
| Daily activity     | 4       | 1       | 0.02    | 1.14           |
| Citizens Reactions | 48.62   | 21.24   | 8.10    | 11.21          |

*Table 2.7. Number of populations, followers, penetration, posts total, posts a day and citizens reactions.*

Analysing the content types for the posts published on the municipalities' Instagram accounts (Table 2.8), we found that the most popular content fell into the cultural and marketing category (44.20%). This result suggests that municipalities tend to use their Instagram account as another cultural and city promotion tool. The second most commonly used category (22.64%) covered a range of topics that were not included in the other categories described. Another favoured category was content related to employment and educational issues (11.05%).

| <b>Content type</b>        | <b>Percentage</b> |
|----------------------------|-------------------|
| Cultural and Marketing     | 44.20%            |
| Other                      | 22.64%            |
| Employment and Education   | 11.05%            |
| Sport                      | 7.90%             |
| Transport and Public works | 5.52%             |
| Security and Health        | 4.75%             |
| Environment                | 3.95%             |

*Table 2.8. Percentage of content types*

Table 2.9 shows that the most frequently used media type were pictures (82.55%), which was expected. Nevertheless, 11.61% of posts were videos, which are becoming increasingly common on this platform. Only 5.84% of posts were albums.

| Media type | Percentage |
|------------|------------|
| Picture    | 82.55%     |
| Video      | 11.61%     |
| Album      | 5.84%      |

*Table 2.9. Percentage of Media Type*

The analysis of citizen reactions was based on the metrics proposed by Bonsón and Ratkai (2013). The findings provided in Table 2.10 show that 100% of the posts received a reaction in the form of likes (P1), while only 33% (C1) of the posts received comments. Similarly, the average number of likes per post (P2) was quite high, 58.19, while the average number of comments (C2) was only 0.81. These measures were later divided by the number of followers and multiplied by 1000, the same technique as Bonsón and Ratkai (2013) applied. This way, we got the average number of likes and comments per 1000 followers. The result suggests that, between these two ways to interact with municipalities on Instagram, citizens tend to choose likes more often than comments as a means of engaging. By summing P3 (20.95) and C3 (0.29), we obtained the average index of citizen reactions (R): 21.25.

|            | Code  | Max.   | Average | Min. | St. D. |
|------------|-------|--------|---------|------|--------|
| Popularity | P1    | 1.00   | 1.00    | 1.00 | 0.00   |
|            | P2    | 199.01 | 58.19   | 8.52 | 52.91  |
|            | P3    | 47.81  | 20.95   | 7.97 | 11.04  |
| Commitment | C1    | 0.76   | 0.33    | 0.08 | 0.19   |
|            | C2    | 3.29   | 0.81    | 0.09 | 0.78   |
|            | C3    | 0.82   | 0.29    | 0.11 | 0.20   |
| Reactions  | P3+C3 | 48.62  | 21.25   | 8.10 | 11.21  |

*Table 2.10. Results of metrics for citizen reactions*

#### **2.4.2. Statistical Analysis of research questions about activity and citizen reactions**

*RQ2: What variables affect the Instagram activity of municipalities?*

This first research question aimed to identify the factors associated with both account activity and citizen reactions on a municipality's Instagram. First, applying bivariate statistics, we examined whether there was any significant relationship between account activity and municipality size measured by the number of inhabitants by calculating the Spearman's rank correlation coefficient (Table 2.11). Our study found that there is no significant relationship.



| Dependent variable            | Independent variable                  | Spearman's coefficient | Significance | Conclusion                 |
|-------------------------------|---------------------------------------|------------------------|--------------|----------------------------|
| Activity<br>(number of posts) | Population<br>(number of inhabitants) | 0.157                  | 0.5466       | No significant correlation |

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

*Table 2.11. Relationship between population and activity*

*RQ3: What variables affect the citizen reactions on Instagram?*

Based on the previous literature, in the second section, the possible variables that determine citizen reactions were identified. However, some were related and some were not.

Table 2.12 present that we did not find any significant relationship with municipality size, but if we found a significant negative correlation with the level of activity and audience. Thus, our findings appear to imply that the citizen reactions are not correlated with municipality size and seems that too high activity or too wide audience generate lower reactions. However, this interpretation cannot be affirmed of this way.

| Dependent variable | Independent variable                  | Spearman's coefficient | Significance | Conclusion                 |
|--------------------|---------------------------------------|------------------------|--------------|----------------------------|
| Reactions          | Activity<br>(number of posts)         | -0.738 **              | 0.001        | Negative relationship      |
|                    | Population<br>(number of inhabitants) | -0.223                 | 0.142        | No significant correlation |
|                    | Audience<br>(number of followers)     | -0.637 **              | 0.007        | Negative relationship      |

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

*Table 2.12. Relationship between activity, population, audience and citizen reactions*

Before off to make an appropriate interpretation about it, we must analyse both correlations that if they have given significant, jointly: audience and activity regarding citizen reactions. Both audience and activity are characteristics of Instagram profiles. Table 2.13 shows that considering both the audience and the activity, it is evident that the audience is not correlated with the reactions of the citizens, while the activity is negatively correlated with the reactions. However, it is a very weak relationship and it only slightly affects reactions. For each post that is published, the reactions are reduced by 0.009. Therefore, having a greater number of posts published implies that the reactions of citizens are reduced very subtly.

In addition, it can be seen in Table 2.5, where the metrics of each municipality appear, that the optimal level to obtain high levels of citizen reactions is to have less than 100 posts published on the profile. From that number of posts, the citizen reactions begin to decrease, albeit in a very subdued way.

| Independent variable | Dependent variable |            |         |              |                            |
|----------------------|--------------------|------------|---------|--------------|----------------------------|
|                      | Citizen reactions  |            |         |              |                            |
|                      | Estimate           | Std. Error | Z value | Sig.         | Conclusion                 |
| (Intercept)          | 28.503             | 3.383      | 8.424   | 7.47e-07 *** |                            |
| Activity             | -0.009             | 0.004      | -2.079  | 0.0565 *     | Negative relationship      |
| Audience             | 0.000              | 0.000      | 0.298   | 0.770        | No significant correlation |

\* Significant at  $p < 0.1$  (2-tailed)

\*\*\* Significant at  $p < 0.1$  (2-tailed)

Table 2.13. Multiple linear regression: Relationship between activity, audience and citizen reactions.

We present Tables 2.14 and 2.15 to study the relationship between the media type and the citizens' reactions. Table 2.14 depicts descriptive statistics regarding media type and citizens' responsiveness, where it can be seen that different media types lead to different levels of reactions. According to the results, pictures generated more likes (92.58) than other media types, although videos received the most comments (1.96), which opened a path for two-way dialogue, as the municipalities could reply to citizen comments. The album media type received the fewest likes and comments.

| Media Type |                | Number of Comments | Number of Likes |
|------------|----------------|--------------------|-----------------|
| Picture    | Mean           | 1.29               | 92.58           |
|            | N              | 15,674             | 1,126,569       |
|            | Std. Deviation | 3.67               | 155.49          |
| Album      | Mean           | 0.93               | 74.22           |
|            | N              | 1,590              | 127,068         |
|            | Std. Deviation | 2.88               | 116.91          |
| Video      | Mean           | 1.96               | 84.62           |
|            | N              | 1,687              | 72,585          |
|            | Std. Deviation | 5.76               | 101.43          |
| Total      | Mean           | 1.28               | 89.89           |
|            | N              | 18,951             | 1,326,222       |
|            | Std. Deviation | 3.75               | 148.93          |

Table 2.14. Descriptive statistics of media type and citizen reactions

Welch's ANOVA test was used to analyse the relationship between media type and citizen reactions. The results suggest that a significant relationship exists between citizen reactions and media type (Table 2.15). Thus, using a particular media type leads to increased reactions (measured by likes and comments). Among the three media types present on the Instagram, pictures and videos led to higher levels of reactions than albums.

| Dependent variables | Independent variable | Method        | Significance |
|---------------------|----------------------|---------------|--------------|
| Comments            | Media Type           | Welch's ANOVA | 0.00         |
| Likes               |                      | Welch's ANOVA | 0.00         |

*Table 2.15. Welch's ANOVA test of media type and citizen reactions. Relationship between the media type and citizen reactions (measured by number of Comments, and Likes)*

To determine if there is a difference in the citizen reactions variable (comments and likes) among media types, an independence test was applied in Table 2.16. The test was carried out for comments and for likes on the different media types (pictures, album and video). Significant differences were found among likes and comments values for different media types.

Since the independence test was significant, a post-hoc analysis was performed to determine which groups differ from the other groups. To identify which of the media types vary, in terms of comments and likes, we carried out a pairwise permutation tests; the results are presented in Table 2.16. It shows that groups sharing the same letter are not significantly different.

|                      |            | Dependent variable |          |
|----------------------|------------|--------------------|----------|
|                      |            | Citizen reactions  |          |
| Independent variable | Media type | Comments           | Likes    |
|                      | p-value    | 9.48E-08           | 9.81E-08 |
|                      | Pic        | a                  | A        |
|                      | Album      | b                  | B        |
|                      | Video      | c                  | A        |

*Table 2.16. Media type: one-way permutation test of independence and Post-hoc test: pairwise permutation tests.*

The pictures, the albums and the videos are significantly different in the comments, while the likes of the pictures are not significantly different from the likes of the videos (and vice versa), only in this case the likes of the albums if they are significantly different

between pictures and videos.

The final research question offered for this study looks at whether different content types generated different levels of citizen reactions. Table 2.17 shows that each post on the municipality's Instagram account generated, on average, 84.90 likes and 1.23 comments. Our findings also show that: (1) transport and public works content generated more comments (1.97); (2) cultural and marketing content and the 'other' category generated more likes, 88.49 and 114.86 respectively. It is interesting to note that these three content types are the ones with the highest standard deviation in the likes and comments. This might occur because these three content types are quite broad, grouping different sub-topics related to their main content.

| <b>Content Type</b>        |                | <b>Number of Comments</b> | <b>Number of Likes</b> |
|----------------------------|----------------|---------------------------|------------------------|
| Cultural and Marketing     | Mean           | 1.27                      | 88.49                  |
|                            | N              | 9,893                     | 691,839                |
|                            | Std. Deviation | 3.89                      | 159.64                 |
| Other                      | Mean           | 1.52                      | 114.86                 |
|                            | N              | 6,081                     | 459,912                |
|                            | Std. Deviation | 4.08                      | 158.90                 |
| Employment and Education   | Mean           | 0.66                      | 47.29                  |
|                            | N              | 1,284                     | 92,401                 |
|                            | Std. Deviation | 1.95                      | 79.57                  |
| Sport                      | Mean           | 0.95                      | 61.81                  |
|                            | N              | 1,324                     | 86,411                 |
|                            | Std. Deviation | 2.51                      | 86.14                  |
| Transport and Public Works | Mean           | 1.97                      | 82.54                  |
|                            | N              | 1,920                     | 80,640                 |
|                            | Std. Deviation | 6.05                      | 146.79                 |
| Security and Health        | Mean           | 0.71                      | 57.93                  |
|                            | N              | 598                       | 48,658                 |
|                            | Std. Deviation | 1.74                      | 93.14                  |
| Environment                | Mean           | 1.04                      | 60.19                  |
|                            | N              | 728                       | 42,013                 |
|                            | Std. Deviation | 2.21                      | 60.50                  |
| Total                      | Mean           | 1.23                      | 84.90                  |
|                            | N              | 21,828                    | 1,501,874              |
|                            | Std. Deviation | 3.72                      | 143.08                 |

*Table 2.17. Descriptive statistics of content type and citizen reactions*

Similarly, Welch's ANOVA test also confirmed that there was a significant relationship between content type and citizen reactions (Table 2.18). The results suggest that, indeed,

different content types may generate different levels of citizen reactions (measured by the number of likes and comments). We found that the most engaging content type was cultural and marketing, transport and public works, and the category 'other'.

| Dependent variables | Independent variable | Method        | Significance |
|---------------------|----------------------|---------------|--------------|
| Comments            | Content category     | Welch's ANOVA | 0.00         |
| Likes               |                      | Welch's ANOVA | 0.00         |

*Table 2.18. Welch's ANOVA test of content category and citizen reactions. Relationship between content and citizen reactions (measured by number of comments and likes)*

To determine if there is a difference in the citizen reactions variable (comments and likes) among content types, an independence test was applied in Table 2.19. It was carried out on the different content types (cultural and marketing, other, employment and education, sport, transport and public works, security and health, and environment). Significant differences were found among likes and comments values for different content types.

|                      |                            | Dependent variable |         |
|----------------------|----------------------------|--------------------|---------|
|                      |                            | Citizen reactions  |         |
| Independent variable | Content type               | Comments           | Likes   |
|                      | <i>p-value</i>             | 1.11E-015          | 2.2E-16 |
|                      | Cultural and Marketing     | a                  | A       |
|                      | Other                      | b                  | B       |
|                      | Employment and Education   | c                  | C       |
|                      | Sport                      | d                  | d e     |
|                      | Transport and Public works | e                  | A       |
|                      | Security and Health        | c                  | E       |
|                      | Environment                | a d                | D       |

*Table 2.19. Content type: one-way permutation test of independence and Post-hoc test: pairwise permutation tests.*

Since the independence test was significant, a post-hoc analysis was performed to determine which groups differ from the other groups. To identify which of the content types vary, in terms of comments and likes, we carried out a pairwise permutation tests; the results are presented in Table 2.19. It shows that groups sharing the same letter are not significantly different.

In the comments, it is given that both "other" content and "transport and public works" content are significantly different respect to the different content types. Between

"employment and education" content and "security and health" content the comments are not significantly different. A similar situation occurs between "cultural and marketing" content and "environment" content, and between "sport" content and "environment" content.

The same does not occur in likes. "Other" content and "employment and education" content are significantly different respect to the different content types, while the likes are not significantly different between "cultural and marketing" content and "transport and public works" content. The same occurs between "security and health" content and "sport" content, and between "environment" content and "sport" content.

## 2.5. DISCUSSION

Instagram is an effective way for government to interact directly with citizens through images, videos, and short snippets of text (CitySourced, 2018). Despite this, according to our results, local governments with a high level of public debt do not adopt or actively use Instagram. Our analysis identifies that municipalities' adoption and active use of Instagram only depends on the financial situation of the municipality, the level of public debt. A possible explanation for this finding is that although entry costs to social media use are relatively low, it is necessary one that for a sustained activity there is a dedication of human, organisational and financial resources (Mickoleit, 2014). Already in 2013, 40% of municipalities in the United Kingdom devote one full-time equivalent or more per week to maintain their social media presence (BDO, 2013). Therefore, the indebted governments do not have the capacity to maintain those resources.

On the other hand, the geolocation, the political leanings' and the population of the municipality do not explain this case. The reasons may be that in the case of geolocation, tourism in both coastal and inland municipalities is similar; domestic tourism has improved in Andalusia but stays in sun and beach destinations have decreased (Agencia EFE, 2018). In the case of the political leanings', governments of the left and right, actively adopt and use Instagram in a similar way. Even though left-wing governments tend to be more transparent (García-Sánchez et al., 2013), right-wing governments are more likely to adopt e-government initiatives (Tolbert et al., 2008). The population is also not considered to be an explanation since SM is considered an accessible medium for any public institution (Criado & Rojas-Martín, 2013)

Our study presents that 58.62% (17/29) of the largest Andalusian local governments maintain an official Instagram account. A similar percentage (67%) occurs in Dutch municipalities (Faber et al., 2019). So that it seems that Instagram is not a SM very used in the local administration field, compared to another SM. This may be because Instagram is a relatively “young” platform, from 2010, compared to Facebook and Twitter, from 2004 and 2006 respectively.

However, it is possible that more local governments will join Instagram, as happened between 2009 and 2011 in the US, when Facebook and Twitter were relatively “young” SM platforms. Just 13% of local governments had Facebook in 2009 and its adoption skyrocketed to nearly 87% in 2011; similarly, the use of Twitter by increased from 25% to 87% (Mossberger et al., 2013). However, this will not occur with the same intensity, since the use of SM is higher in the US than in the EU (Torres et al., 2020).

Despite it seems that Instagram is a slightly consolidated SM in the local administration field. Instagram seems to be an interesting alternative platform for local administrations, as it enables the visual promotion of the city and municipal services for a substantially lower cost than traditional means of advertising. This way, the municipality can leverage Instagram and use it as a dissemination channel for various public issues or initiate a conversation with citizens. Yet a simple presence does not guarantee an active and fruitful communication between the municipality and its audience (Bonsón et al., 2017).

Our 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—the average penetration rate on Instagram was 2.53%, which reflects very small interest on the part of the Andalusian population in following their municipalities on Instagram in general. This contrasts with the data that Instagram is one of the SM with the highest penetration among Andalusians (The Social Media Family, 2018). This can be explained by the fact that Instagram is mainly millennials’ SM, where up to 66% of users are under 39 (The Social Media Family, 2019), and millennials simply do not feel as interested in public issues as the older audience (Fry et al., 2018). The small interest in public affairs among Instagram users is reflected in the low citizen reaction (21.24) that was detected in our study, despite governments' attempts to adapt the methods of communication and make them more digital and mobile, as technology is no longer a choice for the “new policy,” but an obligation (Gutierrez-Rubi, 2017).

Despite the low penetration and participation of citizens with their municipalities on Instagram, this is still an appropriate SM platform for public affairs because highly visual SM has gained remarkable popularity (Marengo et al., 2018), especially among younger people (Bresnick, 2019; Choi & Sung, 2018) and Instagram is a relatively "young" SM platform in comparison with Facebook and Twitter. The other popular highly visual SM platforms, Snapchat and TikTok, are not suitable for local administrations. TikTok has great virality, since a video from a user with absolutely no followers can quickly gain a large audience (Anderson, 2020) but this platform is more of a meme factory (Tolentino, 2019). Snapchat requires creative content that they can disseminate, but this platform has low visibility compared to Instagram because of its feature where content disappears, which restricts comments or likes (Choi & Sung, 2018). Snapchat is a platform more useful for political communication (Morales Ruiz & Romo Jiménez, 2017; Morante & Cuenca, 2017). Instead, Instagram is a platform that spans a large audience, since it has great bridging social capital, so users are likely to be less inhibited, connecting with people who are outside of their daily circle (Phua et al., 2017b), such as their local government.

The total Instagram activity of the municipalities in our study varies. The average daily activity was one post per day, which is in compliance with the average brand posting 1.5 times per day on Instagram (Union Metrics, 2014), since the activity should be frequent, but not overwhelming (Bonsón et al., 2017). By posting once per day, a post is likely to have a +3.39% individual improvement over the average reach, but it decreases from there (Dash Hudson, 2019). Yet, as Patel (2016) states, it is not posting frequency but consistency that matters.

In our study, we found that pictures or photos were the most frequently used media type (82.55%) by municipality Instagram accounts. According to Bossetta (2018), the media types that the platform supports, and the limitations imposed on them, directly affect the content that municipalities publish. Although the video format is supported by Instagram, its limitations in terms of length cause a low presence of content such as longer political debates among municipalities on this platform. Overall, the number of video posts was rather scarce in comparison to pictures.

Relevant content is other of the key aspects to gain an audience's attention. Municipalities therefore should to actively incorporate this visual platform into their online



communication strategy, where cultural and marketing content type is the most common across the analysed Instagram accounts (44.20%). While one can argue that all SM serves self-promotion (Alshawaf & Wen, 2015), it is particularly notable in the case of Instagram, where it is a main feature exhibited more than other SM platforms (Marcus, 2015). Instagram is used more to present the ideal self instead of the true self, for showing off and drawing attention from others by posting self-presentational photos (Choi & Sung, 2018). Moreover, Instagram is a SM platform that has features that support tourism communication activities (Purnomo & Muhibbin, 2018).

While local governments use Facebook as a complementary means of providing transactional e-government services and use Twitter to supplement online information services (Gao & Lee, 2017), they use Instagram to promote their city, publishing posts of its streets, its landscapes and its regional holidays, giving value to the municipality to promote tourism.

The results of our study also show that citizens opt more often for like buttons in comparison to comments while interacting with municipalities on Instagram, which is very likely due to the simplicity of this method. By clicking the 'like' button, citizens can express their opinion quickly and easily. In addition, the 'like' button on this platform can also offer greater visibility than a comment, as the individual's name may appear immediately below the 'liked' content. However, this finding is not exclusive to citizen reactions on Instagram. The same occurs with other SM, such as Twitter, in both the public, analysing the citizen engagement in municipalities (Bonsón et al., 2019), and private sector, analysing the stakeholder engagement in hotel industry (Bonsón et al., 2016).

Regarding the determinant of activity, our analysis did not find a significant relationship between the size of the municipality and Instagram activity. Being a municipality with a lot population does not automatically imply more activity on Instagram. In this respect, the same does not happen on Facebook with Western European municipalities, Bonsón et al. (2017) reported that bigger local governments tend to be more active than smaller municipalities when it comes to SM usage. However, the use of SM involves fixed costs (Guillamón et al., 2016), so once Instagram has been adopted, both large and small municipalities have the same ability to publish their posts.

Other aim of our research was to shed light on what determine the citizen reactions on

Instagram. Our findings outline that citizen reactions were negatively associated with activity. Instead, previous studies concluded that a public administration maintains a high level of activity in SM, this will not necessarily lead to its citizens becoming more strongly reactions (Bonsón et al., 2017; Ma, 2013). In our case, this is due to Instagram's algorithm. Instagram opted to remove the chronological order of posts in the feed to base the algorithm on the engagement of the content (García, 2019). Instagram (2019) tweeted:

What shows up first in your feed is determined by what posts and accounts you engage with the most, as well as other contributing factors such as the timeliness of posts, how often you use Instagram, how many people you follow, etc. [Tweet]

So, if the publications do not get engagement, that is, if the citizens do not comment or share the publications of the local government, the organic algorithm will penalise it and will allow less and less people see it (Lopez Acera, 2018). The algorithm "understands" that if nobody likes the content, then it is not interesting content and the visibility of the publications in their followers' feeds will be reduced.

This is what has happened to the Andalusian governments, since, in general, they obtain a low level of reactions because Instagram users are mostly young people (The Social Media Family, 2019), who are not interested in public affairs (Fry et al., 2018) and they will follow many profiles that even they do not know them in real life, including celebrities and other public figures (Phua et al., 2017b). The profiles of public figures could be more interesting, so the citizens react more with them, since if they follow them without knowing them, it would be due to an affinity or admiration for that profile (Coelho & Machado, 2019) rather than a feeling of belonging to the community which is a reason to follow the municipality's account (Paucar Quispe & Arias Quintanilla, 2019). Therefore, although the local governments continue to publish, the posts will not be shown in citizens' feeds and, in this way, they will receive fewer reactions.

Neither the population nor the audience are related to citizen reactions. A municipality with a high population or audience on Instagram will not necessarily lead to its citizens becoming more strongly engaged. However, Ma (2013) had earlier observed the phenomenon of large audience and lower citizen reactions and argued that it might be explained by a feeling of closeness or a perception that one's voice can actually be heard in smaller communities. Citizens feel more encouraged to express themselves, but communication is more difficult in larger communities, so SM is used as a means of

strengthening networks with agents in that community (Gao & Lee, 2017).

Therefore, taking into account the results on citizen reactions previously discussed — that greater activity on Instagram reduces city reactions due to the algorithm of this platform together with the minimal initial interest of its posts and that the size of the population or audience does not affect the reactions — we can demonstrate that it is true that the number of followers is nowhere near as important as the type of followers you have (DeMers, 2014).

Another finding emerging from this study is related to relationship between the content and media type with citizen reactions. Our results suggest that pictures or photos generally produce higher rates of likes, which has been previously pointed out by several studies (Bonsón et al., 2015; Davison, 2007; Graves et al., 1996; Hofmann et al., 2013; Zavattaro et al., 2015). A picture, generating more likes than other media types, can significantly increase the visibility of the post (Araujo et al., 2014). On the other hand, video is the media type that produces the highest response rate and, therefore helps to initiate a dialogue with citizens.

Regarding the question of which content type generates higher citizen reactions, we found that cultural, city promotional and ‘other’ content generated the most likes, but the content type that received the most comments was related to transport and public works. Some cities use Instagram to promote local scenery or even to educate travellers on what they can and cannot travel with on local transportation, and to engage with citizens who have questions (Hootsuite, 2018). While some studies argue that there is not such a single topic that would guarantee higher citizen reactions (Hofmann et al., 2013), other studies were able to identify certain patterns and found that cultural and city promotional content seem to be the most engaging (Bonsón et al., 2019; Bonsón & Bednárová, 2018). Our findings are in compliance with the latter. Nevertheless, a possible reason for such a popularity of city promotional content within our sample might be that Andalusia is one of the most popular tourist destinations in Spain (INE, 2018). The three Andalusian cities Seville, Malaga and Granada are among the most popular cities on Instagram hashtag-wise (Holidu, 2017).

### ***Contribution to social media research and practice***

Once the results of the research questions were obtained and discussed, we can see that

our research sheds light on how local governments use Instagram. The SM field of research for public administration has concentrated in the study of Facebook and Twitter, leaving Instagram aside (Blank & Lutz, 2017).

This may be because Instagram is still a relatively “young” SM compared to Facebook and Twitter, and it is now that its popularity is growing (We are social & Hootsuite, 2020). It may also be due to the difficulty of analysing posts because the Instagram API is very restrictive or almost non-existent (Murthy et al., 2016). Academics may have seen, as our study has shown, that local government posts on Instagram generate little reaction from citizens.

Some of our contributions have already been demonstrated on another SM platform. As the most indebted municipalities do not usually adopt and actively use SM, and the importance of quality versus quantity of followers. However, we demonstrate that citizens do not have much interaction with their local governments on Instagram and have suggestions on how the posts should be so that they generate greater reactions from the citizens.

In the same vein, we believe that the results emerged from our study may have practical implications for public-sector community managers in charge of online communications. Insights from our study might help them to better formulate and set their online communication strategies by revealing factors that might lead to higher citizen responsiveness.

For instance, a smaller but more engaged audience interacting with the municipality is better than a large number of inactive followers. Similarly, local government activity in terms of posting should be focused on quality rather than quantity of messages.

As technology is no longer an option for the “new policy”, but an obligation (Gutierrez-Rubi, 2017), to attract more quality followers, municipalities should use Instagram effectively. However, it is not enough to approach the audience by adapting communication methods and making them more digital and mobile. They should also publish in a way that interests’ citizens. Transmitting messages through creative posts, can attract millennials and involve them in these matters.

If the intention of the municipality is to obtain feedback or to generate a debate through the comments, the most appropriate media type would be the video format. On the other

hand, if the municipality's objective is the dissemination of information or an event promotion, then a photo/picture format is the best option for the higher visibility.

Municipalities might also bear in mind that the content types that are generally less interesting, such as education and employment or health and safety, should be published by means of pictures or videos, but not in an album, as this would generate even fewer reactions.

In addition, the present study provides implications for the private sector as well, in particular, small businesses, as the results of this analysis can be applicable to the behaviour of their followers. In order to have an attractive Instagram profile, small businesses should know which media and content types are the most appealing to their audience to establish a successful online communication strategy on this platform.

Before establishing an online communication strategy on Instagram, a municipality should clearly define the main purpose of their Instagram profile (inform, initiate a debate, promote, etc.) as users are not likely to spend their time and effort actively participating in the municipality's SM without being sure of the benefits and value that can be derived from their continued participation (Al-Debei et al., 2013; Bonsón et al., 2017). Perhaps the most important aspect of online communication is the ability to have a fluent conversation with citizens when addressing their queries. Within the dialogic communication, the municipality should try to address the complaints, suggestions and needs of citizens (Junta de Castilla y León, 2012). This is a strategy which, if applied correctly, creates a win-win situation, as when municipalities are able to identify and solve problems, the general quality of public services improves as well.

## **2.6. CONCLUSIONS**

As far as we know, this is the first study exploring how municipalities use Instagram to communicate and engage with citizens. Our study provides a robust initial assessment of Instagram usage in the public sector by analysing all of the posts published by the largest Andalusian municipalities. The following questions were addressed: (RQ1) To what extent do municipalities use Instagram as a communication channel to engage with their citizens and what motivates its use? (RQ2) What variables affect the Instagram activity of municipalities? (RQ3) What variables affect the citizen reactions on Instagram?

The results suggest that the adoption and active use of Instagram depends of public debt,

and when local governments have a high level of indebtedness, there is no adoption and active use of Instagram.

A little more than half of analysed Andalusian municipalities have an official corporate Instagram account with different levels of activity and audience where content related to cultural activities and city promotion was the most posted.

In terms of citizen reactions, the most frequent interaction from citizens was through likes. In addition, the population of the municipality does not seem to be correlated with the level of reactions, nor does there appear to be a correlation between the size of the municipalities' audience on Instagram and the citizen reactions. However, a significant negative relationship was found between the reactions and the municipality's Instagram activity. This implies that the local government should focus less on follower count and more on their reactions.

The results emerging from this study also show that pictures or photos lead to more likes than other media types, while videos generate more comments. Regarding content type, posts related to cultural, promotional and the 'other' category tended to generate more likes, while content related to transport, and public works generated the highest rate of comments, both (likes and comments) being attributes of citizen reactions.

In short, the local governments that tend to adopt and actively use Instagram are those with a low public debt, and their activity on Instagram has a negative influence on citizen reactions, while certain media and content types can stimulate higher levels. Furthermore, despite the low reaction of citizens to posts, Instagram is a useful SM platform for local governments to attract more tourism to their municipalities.

## **2.7. LIMITATIONS AND FUTURE RESEARCH**

Before closing, a number of limitations have to be acknowledged. The first limitation is related to the objective of the study. In the present study, citizens' reactions were analysed merely through the number of likes and comments; the content of messages was not considered. Therefore, an interesting line of research might be to conduct a study exploring the reasons that lead users to interact with municipalities' Instagram accounts. By analysing the content, it would be possible to examine how they express their social and political opinions to local governments' issues or how they respond to Instagram messages posted by these institutions.

The stories that governments upload have not been analysed since they are beyond our reach. It would be interesting to see how they usually treat their stories and how the citizens react to them. However, it was impossible for this analysis since stories are only kept in the profiles for 24 hours and the reactions to them are not visible to the public (they can only be seen by the one who posts the story). However, it may be possible to analyse the content and type of media in the stories that local governments have indicated as highlights as they are fixed in the feed. By considering the content of messages and stories, we would be able to analyse citizen engagement in more depth.

Thus, considering the content of messages and stories, we would be able to analyse citizen engagement in more depth.

There is also a limitation related to the sample. A sample bias occurs as only 29 municipalities were analysed, which might have implications for the generalisability of the results. This study therefore opens new avenues for future research where the number of samples could be extended. Instead of analysing the Andalusian municipalities with more than 50,000 inhabitants that represent 50% of the Andalusian population, one could study municipalities with more than 10,000 inhabitants, which means 80% of the population in Andalusia. We could even contemplate all the Andalusian municipalities, 100% of the Andalusian population, since the automatic process of the methodology we used for both the collection of tweets and their subsequent analysis requires little effort.

Regarding the statistical analysis, the limitations of our study stem from the non-normal distribution of our data. Hence, nonparametric alternatives such as Spearman's rank correlation and Welch's ANOVA were adopted, which are generally less accurate than parametric tests.

A limitation related to the automated content analysis should be acknowledged as well. This method classified the posts using a dictionary of the most frequent words. Although this approach eliminates subjectivity, the classification process is a subject to a certain level of error in case that there are ambiguous posts that belong to more than one category. Future research might therefore try to come up with more accurate techniques to reduce this limitation. In addition, future investigation might focus more precisely on the sub-categories of the content types—culture and marketing, others, and transport and public works—in order to better understand the high standard deviation of these three categories in the number of likes and comments.

Another limitation of our study stem from the fact that comments and likes were considered proxies for citizens' reactions, yet they might have different contextual meaning. Another factor worth exploring might be hashtags, as according to Duguay (2016), the posts with hashtags are much more visible throughout the online network, which might have implications for citizen engagement commitment (Grover et al., 2018).

The present study has been carried out in Andalusia at the local level of public administration. Nevertheless, the contributions of our study could be applied on other Spanish regions such as Catalonia, Madrid, Valencia or Zaragoza, which report similar rates in terms of Instagram usage (Delgado von Eitzen, 2016; The Social Media Family, 2018). Nevertheless, further research is needed to confirm any similar trends. In addition, further studies might extend the sample across international regions, which might improve the generalizability of the results and also help to identify and understand different trends and tendencies in SM usage in the public sector from the international perspective.

It would also be interesting for future research to consider political characteristics of the municipality to study its effect on citizen reactions. We found that the municipality with the greatest citizen reactions was Estepona, which curiously has the most voted-for mayor in Spain in large municipalities over the last two municipal elections (Europa Press, 2019). Therefore, there could be a positive relationship between citizen reactions on Instagram and the satisfaction of citizens with elected representatives.

Last but not least, an interesting line of research might be to understand whether the sentiment (tone) of the message can positively influence citizen participation on local government Instagram accounts. For example, on Twitter, a positive tone accompanied with photo sharing, exclamation points, and retweets tends to generate more active participation (Zavattaro et al., 2015).



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**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



### 3.1. INTRODUCTION

Air and water pollution, waste disposal, deforestation and CO<sub>2</sub> 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

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 2030<sup>th</sup> 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.

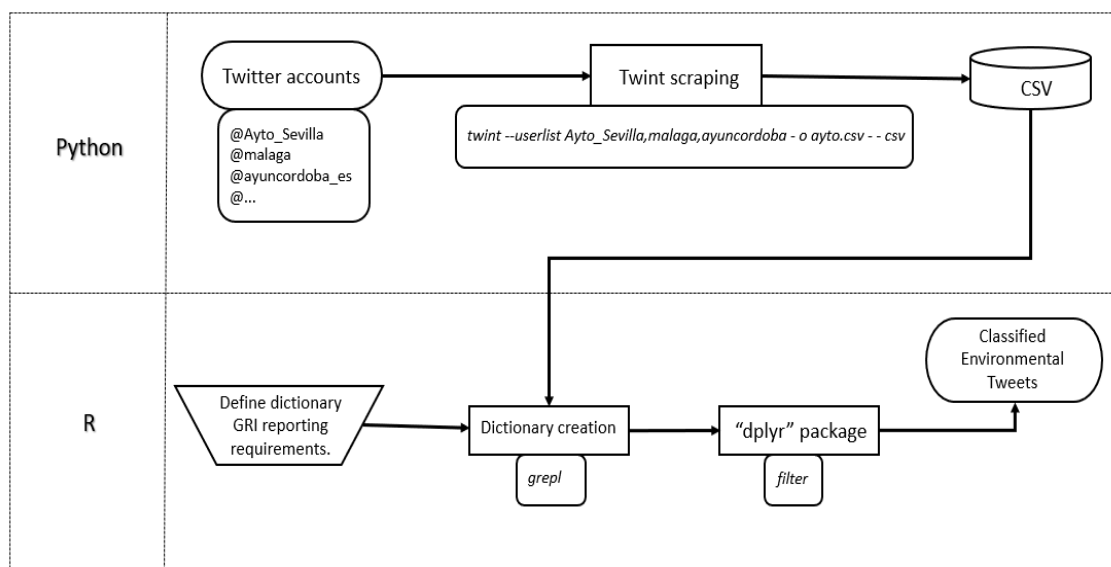
To identify the Twitter accounts of the selected municipalities, a multi-track search strategy was carried out as follows: (1) Search for logos or Twitter links on the homepage of the municipality website. If the Twitter/link logo was not available on the home page,

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 ( $\text{TEDI} = \text{number of environmental tweets} / \text{total number of tweets}$ ).

#### **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                                                                                       |
|--------------------|------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>Dependent</b>   | 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           |
| <b>Independent</b> | 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:

$$(TEDI = \alpha + \beta_1 GovBudgBalH + \beta_2 UnempRat + \beta_3 Popul + \beta_4 Geol + \beta_5 PolSing + \beta_6 SustCommitNet + \epsilon)$$

### 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%).

|                | <b>Maximum</b> | <b>Average</b> | <b>Minimum</b> | <b>St. D.</b> |
|----------------|----------------|----------------|----------------|---------------|
| 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 (Lapiente 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.

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## **CONCLUSION**

The three articles that make up this thesis have been published (or accepted for publication) in high-impact international academic journals such as *Government 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).

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

*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, that report the most on environmental issues through Twitter.

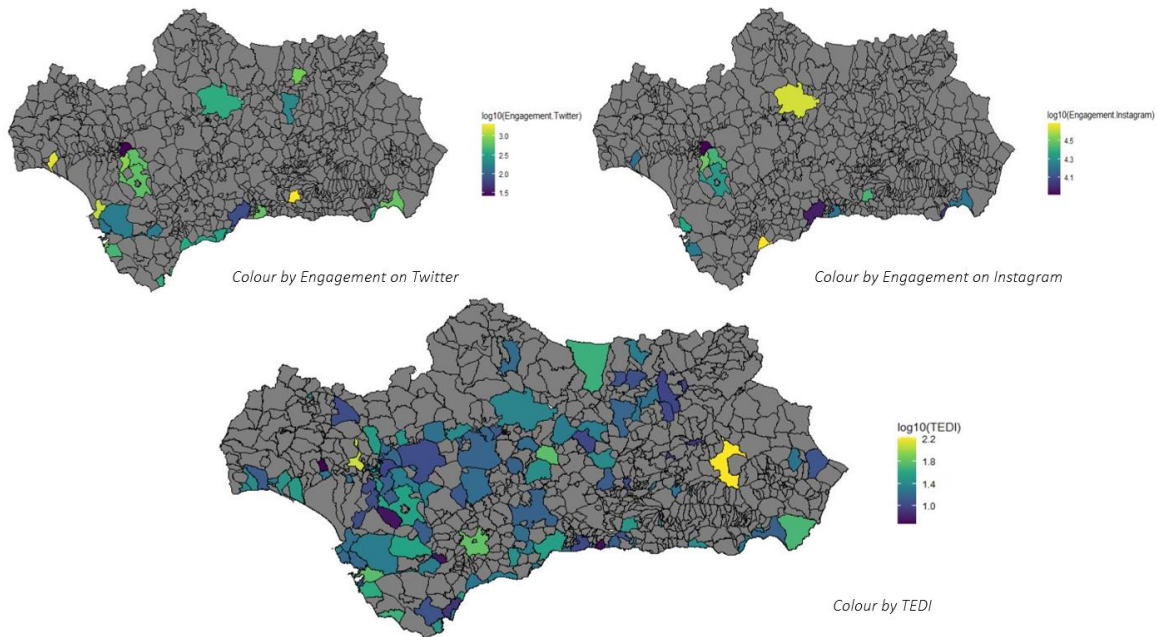
Chapter 3 offers an overview of how Twitter is being used by local governments for outreach on environmental issues. According to our results, the use of Twitter as an environmental disclosure tool (TEDI<sup>27</sup>) is almost non-existent, despite its potential considering that it is demanded by citizens.

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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<sup>27</sup> 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*



### ***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.

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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.

## CONCLUSION

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 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.